WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

ELECTRIC boats are already in use on the Manchester Ship Canal between Eastham and the Weaver. The boats are a success, and a fleet of them will shortly be afloat.

* *

An instrument has been designed for drawing parabolas of short focus, such as are required for reflectors. Its construction is based on the property that every point in the curve is equidistant from the focus and the directrix.

* *

Cement is wanted in Russia. Vice-Consul Robinson represents that there is a demand for cement, of which a dearth exists in Russia. There are only 800,000 tons of cement made in Russia—in England 8,300,000 tons annually. A large trade awaits the enterprising British merchant.

* *

A chance for cycle makers presents itself in Belgium. The Belgian Minister of War has announced that a series of cycle trials will be held between June and November this year at Wavre to decide upon the type, pattern, and make of machines to be ultimately adopted by the Belgian army. English manufacturers should go in—and win.

* *

Large glass tanks for chemical manufacturing processes have long been a desideratum. The largest tanks have hitherto been produced by blowing, and never exceeded a length of 2 ft. The Armstrong Glass Company have now succeeded in making large tanks by a process of building up the tank with plates or sheets of glass, and then fusing the edges together.

* *

An important find of coal has been made at Bredbury, near Stockport. After two years' labour a good coal seam 5 ft. thick has been reached. The mining engineers had considerable difficulties to encounter in sinking the pit, the red sandstone giving off much water. This has been shut out of the pits by about eighty yards of cast-iron lining.

Workmen have begun raising trusses to support the roof of the Manufactures Building of the Chicago Exhibition. These trusses—twenty-two in number—will be the largest in the world, each covering a span of 688 ft. Over the centre of the roof, inside, to the ground floor, will be a distance of 206 ft. Each truss weighs 200 tons, and a total of 6,000 tons of steel will be used in the roof of the building.

* *

A steel wire railway carriage seating is taking the place of padded, and volute spring seats. The new seat consists of minute steel wire rings compactly knitted together, with a thin layer of hair or felt padding over them. The London & North Western and Great Eastern Railways are adopting them. Something now needs to be done, especially by the underground railway companies, to guarantee us from infectious diseases which can be so readily taken in much frequented and indiscriminately used railway seatings.

* *

Considerable interest has been excited in engineering circles concerning a process which has been discovered for enamelling the interior of boilers, with a view to the prevention of corrosion and incrustation. Experiments have been proceeding with the process for the last three years, and the results are certified to be of a most surprising and successful character. More tests are being applied, and if what is claimed for the process be definitely attained, the gain to engineering generally will be great.

* *

In the Brin process of production, oxygen is absorbed by baryta heated to a temperature of about 1,100° Fahr. The baryta is subsequently heated to 1,600°, when it gives off the oxygen previously absorbed. A producer capable of yielding 10,000 cubic ft. of oxygen in twenty-four hours consists of twenty-four cast-iron retorts, 13 ft. long, 6½ in. internal diameter, and 1 in. thick, laid at an angle of 30° to the horizon. These are charged with 2,100 lbs. of baryta; air is forced in at 10 lbs. pressure above the atmosphere, and the oxygen is exhausted at a vacuum of 13 lbs. Before entering the retorts the air is passed through lime and soda purifiers to remove carbonic acid and moisture. The retorts are heated by a carbonic oxide generator.

Plate-glass bricks are being made from the sand formed in the grinding of the glass. The glass is ground by a reciprocating movement of damp quartz sand over its surface, the sand resting upon iron plates having an oscillating motion. The quartz cuts into the glass and iron, and becomes mixed with both, and when sharp edges and particles of sand were worn away, such was heaped up as worthless, but is now made into bricks. After being dried, it is forced into a mould under a pressure of several thousand pounds per square inch. The bricks thus formed are then baked at a temperature of 2,732° Fahr. These bricks are perfectly white, will withstand frost, are not attacked by acids, and will resist a crushing force of from 800 lbs. to nearly 1,000 lbs. on 0·155 square inch. We can imagine a variety of directions in which a glass brick might be employed with especial advantage to those who build houses, and still more so to those who have to live and work in them.

* *

A new hand camera will shortly be in the market. It is light and compact, with a new method for change of plates. The camera for ¼-plate size measures 11½ in. long, 5 in. wide, and 4 in. high. It is divided into four compartments: the first contains the lens and shutter, and is in front; behind is the second, which is the exposing chamber; and behind this are two chambers one above the other. The upper chamber contains the stock of plates lying horizontally, and the lower chamber receives the plates after exposure. In these chambers is a cage, which, as a plate leaves the upper chamber, falls, and receives the same on being returned from the exposure chamber, and so on for every plate in succession, so that all the plates from the upper chamber are finally placed in the lower one. Between the two chambers and the exposing chamber is a narrow slit with a shutter, which opens and closes automatically, through which the plates pass and repass. In the exposure chamber is a tumbler balanced on its centre, and moved from a vertical to a horizontal position by a milled head from the outside. This movement changes the plates, which can be returned from the exposure chamber to the upper chamber. The plates are used in sheaths, and there are no springs, grooves, or rods, and no chance of the plates being jammed. Photographers will watch it.

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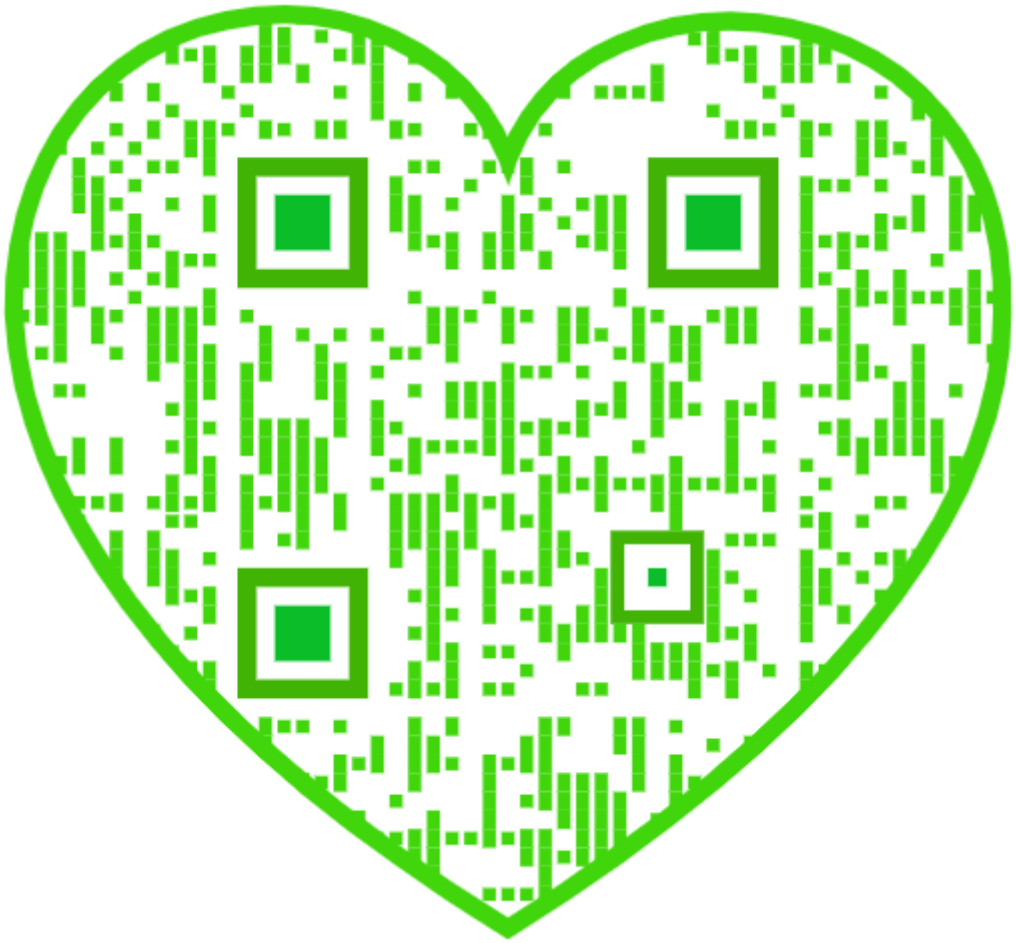

ABOUT WORK AND POWER.

BY W. C. CARTER, M.I.MECH.E.

An interesting case suggests itself, which might have been discussed at an earlier stage, but it is too instructive to be omitted. Suppose that a house has at one side a lean-to greenhouse, and one day a man working on the roof dislodges a small pebble accidentally, which, falling upon the glass-house, shatters one of the panes to atoms. We pick up the pebble and look at it, and think, "Well, that is a very small pebble and looks very harmless," and we lay it upon an unbroken pane of glass without its making any visible effect upon it. If asked what change has taken place that the pebble has now no destructive powers, and from what those powers were derived, we should probably answer that its power was derived from the fall, and the velocity it attained in its descent. Of course, such a reply is quite correct as far as it goes, but we shall find it very instructive to look still more closely at the first cause.

The pebble, in breaking the glass, used up work in doing it which must have been given to it at some time. It may have been years ago, but the pebble was at some time or other carried up from the ground-level, where it was harmless, to the height at which, though lying apparently quiescent, it possessed the powers for mischief shown in the damage done; and the fact is—and it might be shown by the laws of gravitation—that the amount of work given out by the pebble when falling was *exactly* equal to its weight multiplied by the height of the house.

We see, then, that this work was originally put into the pebble by the agency which carried it up, and we recognise, therefore, in this simple case that the pebble was a machine having work put into it, to be afterwards given out exactly the same in amount, except the inappreciable loss due to the friction of the air in the fall. This case is, probably, as nearly that of a perfect machine with a modulus of 1 as could be found.

The Switchback Railway.—We have in this modern amusement a very interesting illustration of the all-pervading principle that we are studying. We have here a carriage starting from an elevated position, and depending for its motive power upon the weights of the passengers, which cause it to descend the railway at a great velocity, and then we find the car ascends the opposite inclines, and *very nearly* reaches a position on a level with the one it started from. But, having come to a standstill, the passengers are asked to alight, and the attendants pull the car up to the starting-point for the return journey, which is on a level with the original starting-point, but a few feet above the point where the passengers are discharged. Now, let us see what has occurred, in scientific language. Each passenger, in walking up the steps to reach the starting platform, raises his weight through a certain distance and performs a certain amount of work. It would not be necessary to call attention to this if, on alighting, he descended an equal distance, and thus received back the work done; but, as we know, the passenger does not descend when coming off the railway an equal distance, and thus he has given some work to the car equal to the height ascended and that descended. What, then, has become of the work which he gives up? It has gone to overcome the friction of the machine, and the efficiency of the car as a machine is exactly in the ratio of the short distance *descended* to the longer distance *ascended*. Supposing that the passenger ascended 20 ft. and the car stopped 3 ft. from the top, then the modulus of the car, as a machine, would be $\frac{17}{20}$, and the amount of work expended on friction would be equal to 3 ft. multiplied by the total weight of the passengers.

Modes of Measurement.—As we now see how important it is to be accurately informed as to the relative quantities of work transmitted by machines, we may give a little attention to the methods adopted for testing with accuracy the efficiency of steam-engines and finding their modulus.

We shall first consider the apparatus usually employed for testing the work given off by an engine fly-wheel, and shall conclude our article by describing the means used for finding the work done in the cylinder and the final triumph of scientific reasoning in this direction—the indicator.

The work given off by the fly-wheel is determined by means of a brake, so applied as to just absorb all the work the engine is capable of performing.

The apparatus is so arranged that the amount of the friction acting round the fly-wheel rim can be accurately measured. Then, as we know by timing the revolutions the distance passed through by any point on the fly-wheel rim in one minute, we can, by multiplying them together, obtain the quantity of work that would otherwise be given to the belt upon the fly-wheel.

By referring to Fig. 4, a simple arrangement will be seen which shows the principle on which such brakes are constructed. Round the fly-wheel is passed a band, A, having a weight of w lbs. on its lower end. The other end is carried up to a spring-balance, which can be tightened up until the engine has all it can stand. Then a reading is taken off the balance.

What now is taking place? The weight, w, is supported by two forces. The friction of the band on the wheel was not enough to hold it till the tension of the balance was

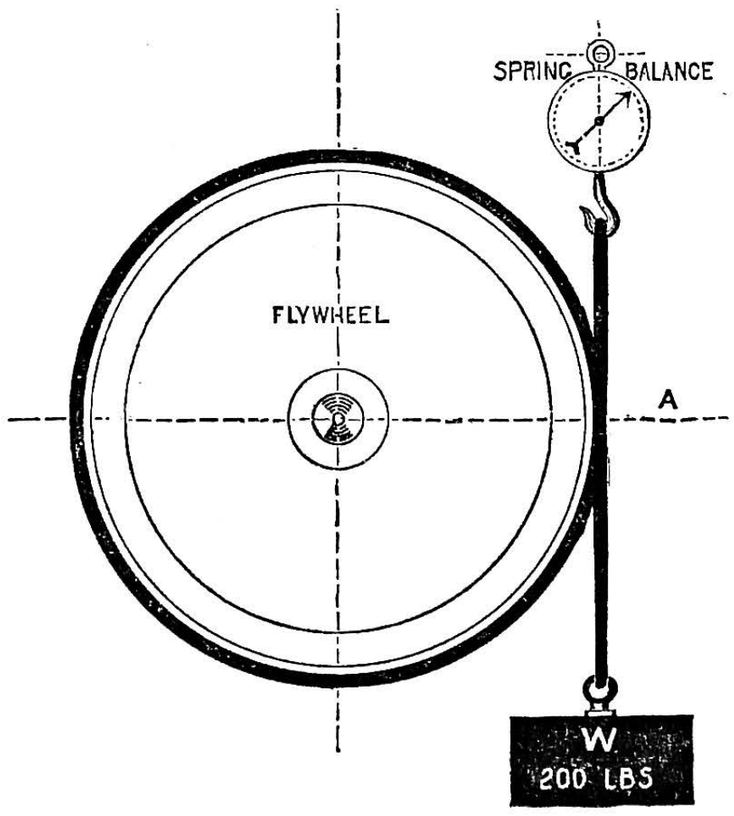

Fig. 4.—Arrangement showing Brake Principle.

adjusted, so that the weight is held by the two forces together. Stated differently: Weight = friction + pull of balance. But we know the weight, and can read the balance, so that the friction = weight − pull of the balance. We now multiply this amount by the circumferential velocity of the fly-wheel in feet per minute, and the result is plainly the effective work given out by the engine. If, now, we can find the work in the cylinder, we shall have the two quantities necessary for finding the efficiency of the engine and determining its modulus. For example, let us suppose the weight, w, to be 200 lbs., and that, when the engine is loaded up all she will stand, the pull on the spring-balance is 15 lbs., then the friction on the fly-wheel rim is 200 − 15 = 185 lbs. Let us suppose the rim velocity of the wheel to be 1,200 ft. per minute, then the whole work done in one minute is 1,200 × 185 = 222,000 foot-pounds; and suppose that, by the use of the indicator, we find that the cylinder develops 250,000 foot-pounds in the same time, then our modulus is

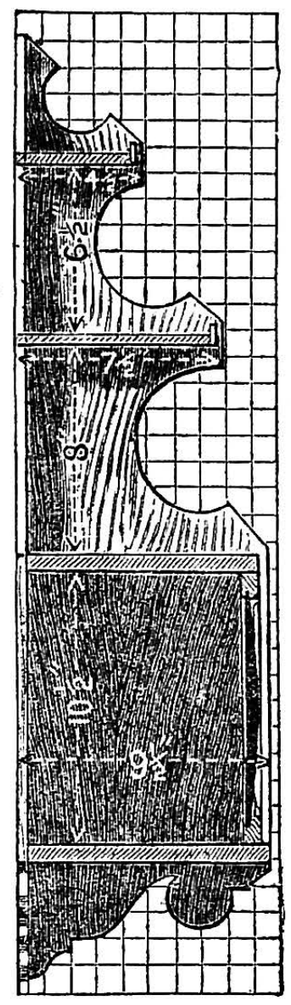

Fig. 1.—Sectional Elevation.

$$\frac{222,000}{250,000} = \frac{111}{125} = .88.$$

We thus perform exactly the same operation in the case of the complicated steam-engine that we did in the case of the simple wedge; and this is the point which it is desired to emphasise—viz., that, however complicated a machine may be made, the process of testing its efficiency is the same in all cases.

We now come to the crowning achievement of scientific analysis, which in its beautiful simplicity and fidelity to discovered truth can be well compared with that of the phonograph; and our concluding article shall be devoted entirely to the Steam-Engine Indicator.

SIMPLE CARPENTRY: A STUDENT'S BOOKSHELF.

BY FRED CROCKER.

Materials—Construction—Polishing.

A hanging bookshelf is an article of furniture that one can always find a corner for, and although the one described in this paper is not very original as regards design, and is easily made, it looks very effective when finished. The cupboard at the bottom is used for the reception of drawing instruments and stationery, the shelves above for text-books, and the top one for specimens.

Materials.—The sides, shelves, and front are made of $\frac{5}{8}$ in. and $\frac{3}{8}$ in. walnut, but baywood, or even pine, may be used if the maker does not like using walnut. The cupboard is backed with $\frac{1}{4}$ in. pine to keep out dust.

Construction.—Fig. 1 is a sectional drawing, not represented here to scale, but divided into squares, so that the reader may easily set it out to any size. The ends of the shelves are housed into the sides—which clean up to full $\frac{1}{2}$ in. thick—to a depth of $\frac{5}{16}$ in., and are glued. As the bottom shelf is the full width of the side, it should be only cut in $\frac{1}{8}$ in. deep at the front and the beads on shelf and side mitred.

Fig. 2 is a front elevation, giving a general view with panels, etc. The doors are framed, the stiles and rails being of $1\frac{1}{8}$ in. by $\frac{1}{2}$ in. walnut; the panels are $\frac{1}{2}$ in. thick in the centre and bevelled to $\frac{3}{16}$ in. at the edges, but if the maker has a taste for artistic

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work these may be made flat and painted or carved. Some excellent designs are given in Nos. 63, 69, and 71 for painted and carved panels for hanging cabinets, and several others that may be adapted to the purpose will be found in the pages of WORK. A hollow or scotia is worked on the inside edges of the stiles and rails of the doors, and as the maker may not possess a tool for making this, a sketch of a rough one that will answer the purpose very well is given in Fig. 3. It consists of a piece of hard wood with a shoulder cut on it to form a guide, and a hand-saw kerf in which is fixed the iron of a No. 4 round, this being held in position by a wood screw. In using this tool, or scratch, as it is generally called, as much as possible is chamfered off with a chisel; then follows the scratch, and the ends are finished with the gouge. The same tool may be used to work a hollow or flute in the centre of the stiles and rails if required.

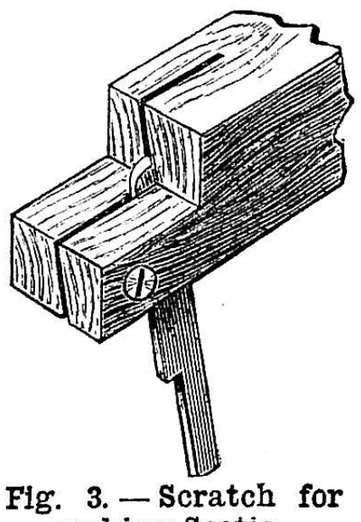

Fig. 3.—Scratch for making Scotia.

Fig. 4 is a sketch of another makeshift which is often used when a bead plane of the required width is not available. It consists of a piece of hard wood with a No. 12 wood screw turned into it and standing out the width of the required bead. In using, it is held in the same manner as a gauge, the nick acting as a cutter to make the quirk of the bead, which is finished on the outside edge with file and a little sandpaper.

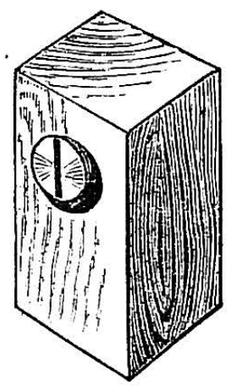

Fig. 4.—Beading Tool.

Each door is hung with two 1 in. by $\frac{3}{8}$ in. brass butt hinges, and it will be noticed that the doors are not hung directly on to the sides as is sometimes done, but a hanging piece is put on each side. This is mortised into the shelves and grooved into the sides to avoid an unsightly joint if it should shrink at any time. The other details of construction may be gathered from the drawings.

Polishing.—As the process of French polishing has been fully described in a previous volume, it will be only necessary to add that the sides, shelves, door panels, etc., should be polished as much as possible before putting together, or a difficulty will be experienced in finishing the corners.

PLASTERERS' WORK.

BY A WORKING PLASTERER.

RUNNING CORNICES, MOULDINGS, BEADS, ETC.—ENRICHMENTS—TRUSSES—CEILING FLOWERS—CASTING—MEASURING.

Running Cornices, Mouldings, Beads, etc.—Cornices are run with a wooden mould; a piece of hard wood, about $\frac{3}{4}$ in. thick, is cut to the profile of the mould, and the left-hand side, looking from the back, is chamfered away, leaving $\frac{1}{4}$ in.; a piece of sheet-brass or iron is then cut to the section of the mould and screwed to the wood, standing up $\frac{1}{4}$ in. above the wood; a block of wood, about $1\frac{1}{2}$ in. square and from 6 in. to 12 in. long (depending on the size of the mould), is fixed at the bottom of the mould, and a stay is fixed on the left-hand side, about $1\frac{1}{4}$ in. diameter. On the opposite side a triangular piece of wood is fixed, on which the surplus plaster cut off by the mould drops. Fig. 5 is a front and end view of a mould. The walls and ceilings are generally floated before commencing to run a cornice, except it is a very large one, with a good deal of work in it, when a screed only is floated, to prevent the floating getting too dry before the cornice can be finished. When a cornice has a large projection, in order to save materials, wood brackets are fixed at intervals, which are lathed and coated with mortar at the same time the ceiling is pricked up. The depth and projection of the cornice are then marked on the walls and ceiling in each angle of the room, and between these marks level screeds of gauged stuff are run on and made perfectly straight; lines of red chalk are then struck on the screeds upon the walls the exact depth of the cornice, and laths about 2 in. wide, with one edge shot straight, are nailed to these marks, forming a level surface on which the mould is to run. Two workmen are generally engaged in running a cornice. A pie of putty is formed on the board or banker; into this water is poured, and the plaster is then sprinkled into the water by hand, and the whole is mixed up by the gauging trowel. One workman then takes a quantity of the gauged stuff upon his handboard, and applies it on the line of the proposed cornice; the other workman then applies the mould at one end, and runs it along upon the lath. The surplus stuff cut off by the mould falls off upon the board at the right-hand side of the mould, and is, with another portion of the gauged stuff, applied to any portions of the cornice which have not been brought up full. When the cornice is nearly full up, the gauged stuff is made very thin, and dashed on with a brush,

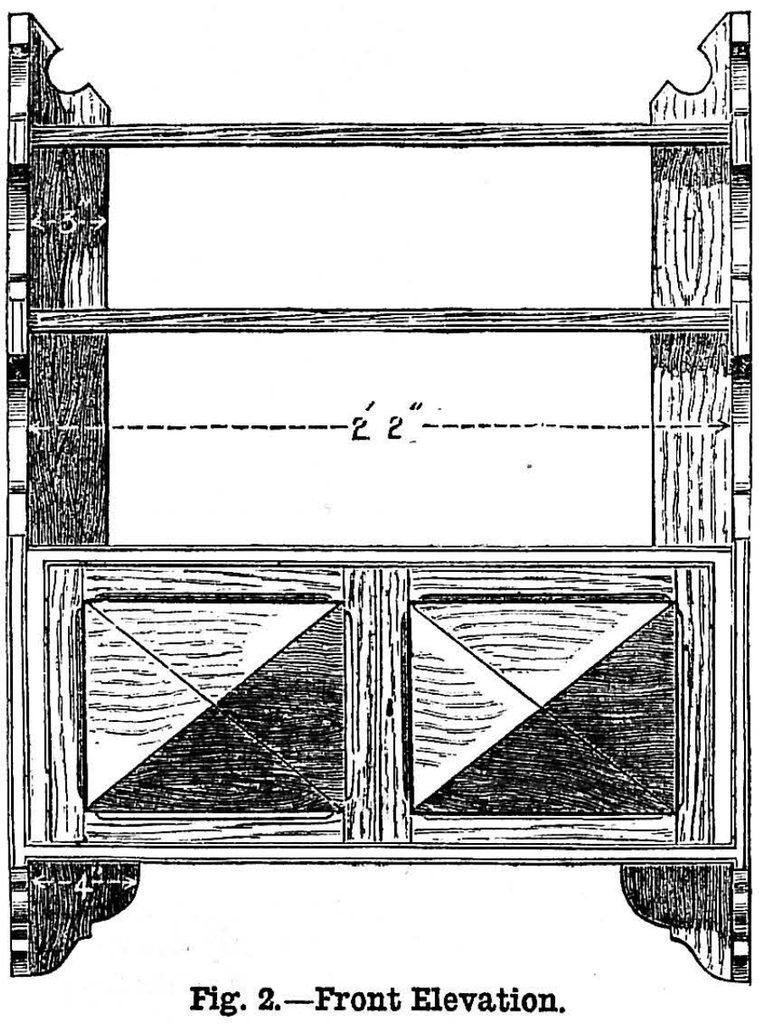

Fig. 2.—Front Elevation.

till it is run full up to the mould. Should any of the gauged stuff set, it must not be remixed with water, as it is what is termed "killed," and will not then set. Sometimes the mould (in beginning to run the cornice) is "muffled"—that is, the smaller members are filled up with plaster, which is allowed to set, and is cleaned out after the larger members have been brought up nearly full. It is essential, after the gauged stuff is mixed, that great expedition be used, so that it does not set. Where a projection, such as a chimney breast, occurs, the cornice is run past at each end as far as the cornice projects, a piece of lath being nailed on the back of the cornice lath to guide the mould. Two stays are also fixed against the projecting end of the lath to keep it firm while running the cornice. When the whole of the cornice has been run, the laths are taken down and the mitres or angles are put in by hand, by means of the mitring tools and rules. Beads, splays, and chamfers are run in a similar manner. Moulded skirtings are also run with a mould, the lath being nailed on the floor. When the skirtings are of Parian cement, they are cored or floated up with Portland cement, to save the more expensive cement.

In running circular beads or architraves, the centre is marked on a board fixed across the opening and an iron pin put in. The mould is fixed on a lath, the other end of which has a hole made in it, and which works on the pin. A screed is worked round the outside of the arch, and the mould is run round.

For elliptic arches a trammel (Fig. 6) is used. This consists of two grooves at right angles to each other. A slide with an iron pin in it works in each groove. The mould is fixed on the end of a lath, as for circular work, and two holes are made in the other end of the lath. These are fixed on the pins in the slides. As the mould is moved from left to right, the slide in the horizontal groove moves from left to right, and the slide in the vertical groove moves downwards till the centre is reached, when the horizontal slide still moves towards the right, and the vertical slide moves upwards. The distance between the two slides determines the form of the arch. When wide apart the arch is flatter, and when near, it approaches nearer to a circular form. Returned mitres, and other short pieces of cornice, are generally run on a board, squared and mitred by a saw, and fixed in position with liquid plaster.

Enrichments.—These are ornaments of various forms, cast in plaster-of-Paris. They are fixed between the members of a cornice, or at the top and bottom, and sometimes in both positions. They are cast in various lengths. Fig. 7 represents two forms of enrichments. In running the cornice, grooves or rebates are formed, into which the enrichments are fixed with liquid plaster.

Enrichments are also made of carver's compo, a mixture of glue, resin, and whiting; in papier-mâché, with a priming of whiting and glue over it; and in carton-pierre, with layers of whiting and glue. These enrichments are lighter and more flexible than those made of plaster, and can be bent and fixed with screws.

Trusses are cast in plaster-of-Paris, and are of various forms and sizes. Fig. 8 represents a truss. They generally have a moulded cap fixed on the top. They are fixed at the springing of arches and in similar positions.

Ceiling Flowers.—These are cast in plaster, and are in several pieces. Fig 9 shows one form of ceiling flower. They are fixed in the centres of ceilings, and in panels formed in ceilings. When a gas pendant or chandelier is fixed in the ceiling, the centre of the ceiling flower is cut out to fit the wood pateris of the gas-fitting. When the various pieces of the ceiling flower do not touch each other, centre lines for each separate portion of the flower are marked on the ceiling, to which the different pieces are fixed. They are also made in papier-mâché, etc.

Casting.—The casting of ornamental

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work for plastering is executed with plaster-of-Paris in moulds of wax, plaster, or gelatine. In order to make a mould, the pattern—which may be modelled in clay or may be an existing ornament—is well oiled on the face and laid on a board, or other level surface. An open frame of the requisite size is laid round it, and the melted wax, or liquid plaster, is poured in till level with the top of the frame. As soon as it has stiffened, the frame and the pattern are taken away and the mould allowed to set hard, when it is ready for use. The mould is then oiled and filled with liquid plaster, which is removed as soon as it has set and laid in a dry place to harden. When the moulds are made of plaster, they are varnished with one or two coats of shellac varnish, to prevent the oil sinking in. A backing of plaster is generally formed on enrichments, provision for which is made in the mould. When the castings are light and of open-work, a backing of canvas, wood, or pieces of wire is put on. When the pattern is undercut, a flexible mould is used, which is made of glue or gelatine in the following manner:—

The pattern is oiled and laid on a level surface, and covered with clay to the thickness of the proposed mould. A wall of clay is then formed round it at a certain distance, and in the space thus formed a case of plaster is cast, leaving a hole at the top for pouring in the melted gelatine, and a few air-holes round the side of the case. As soon as the case has set, the pattern, with its covering of clay, is taken out. It is again oiled and covered by the case, and the melted gelatine is poured in, the air holes being plugged when the gelatine has risen up to them. As soon as the mould has set, the pattern is taken out, the mould is oiled and filled with plaster, and, when this has set, it is taken out of the mould. Great care is needed in removing the mould, so as not to break off any of the projecting parts of the cast. If the mould should get too hard, it is softened by heating or dipping it into hot water. In some cases a plaster case is not required.

Piece-moulds are also used for casts which cannot be drawn from the mould. They are formed of plaster, and jointed together. Fig. 10 shows a piece-mould for a truss in five pieces. It is formed in the following manner:—

The pattern is laid down and levelled up all round to the requisite height with clay, about 1 in. wide. Round this a wall of clay or open frame is laid. The pattern is oiled, and this is then filled with plaster. As soon as it has set the plaster mould is taken off, and dowel holes are formed on each side by cutting the plaster out (as shown in Fig. 11). The mould with the pattern in it is then laid down, and a wall of clay formed at each side. These spaces are then filled with plaster, which is removed when set. The plaster will have run into the dowel holes, and will form pins, so that it will go together again. Dowel holes are then cut in the ends of these pieces, and walls of clay formed at the two ends, which are filled with plaster, and so complete the mould. When quite hard it is bound tightly together with cord, oiled, and filled with plaster. When this has set the mould is taken away in pieces, leaving the cast.

When piece-moulds are made for articles of a circular or irregular form, a plaster case is made for the pieces to fit into. A good deal of ingenuity will be exercised in making a good piece-mould, but when well made it will last a long time; and the only drawback to it is that small ridges are sometimes formed at the joints of the mould, which are easily removed by a scraping tool before the casts have set hard.

Measuring.—Plasterers' work on walls, ceilings, and stoothings is measured by the superficial yard. Ordinary sized openings are generally measured in, to allow for the labour of plastering the jambs or reveals. When the openings are deducted, the jambs and reveals are measured separately. The quirking of beads is measured by the lineal foot.

Rough casting and concrete floors are measured by the superficial yard.

Cornices, beads, splays, chamfers, skirtings, and architraves are measured by the lineal foot or by the superficial foot, the girth of the moulding being taken.

Mitres, breaks, and returns are counted at so much each.

Enrichments are measured by the lineal foot.

Trusses, keys, bosses, and ceiling flowers are counted at so much each.

Panellings, pilasters, fascias, etc., are measured by the superficial foot.

Copings, kerbs, and similar works are measured by the superficial foot.

The price generally includes all scaffolding, tools, etc., except in special cases.

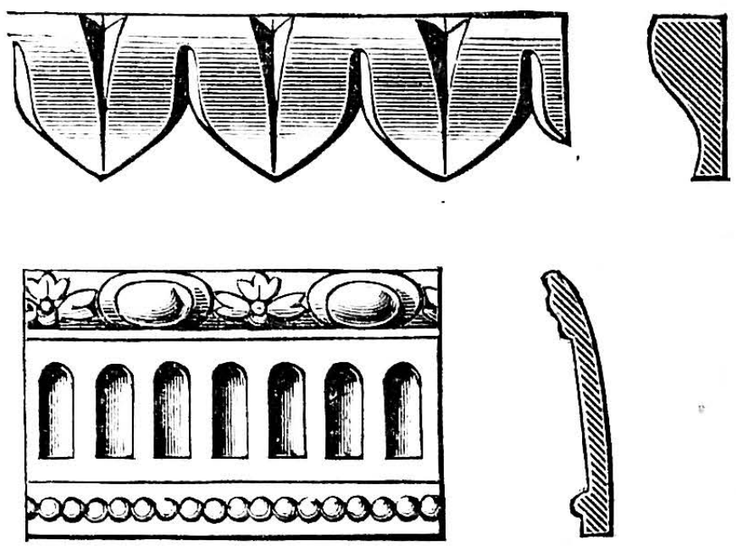


Fig. 7

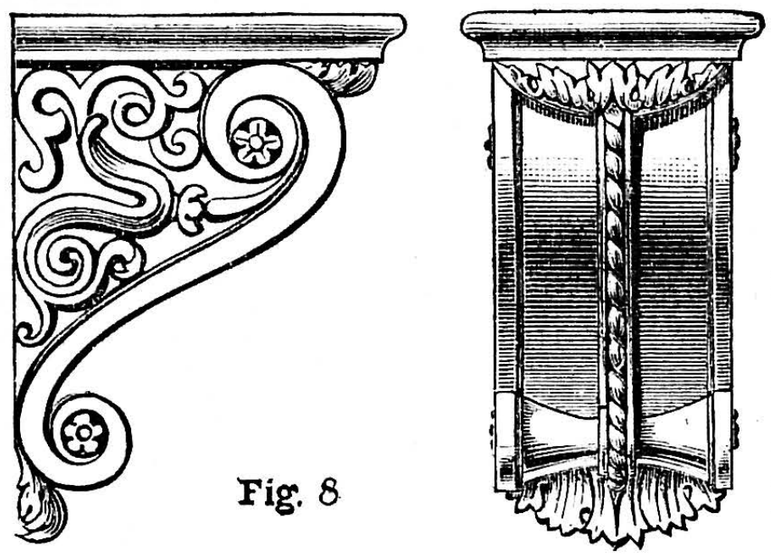
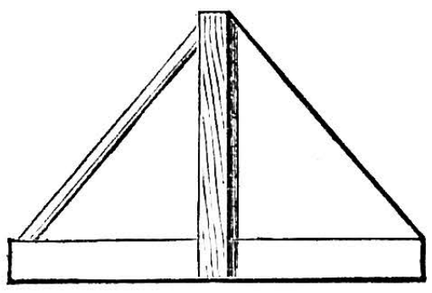


Fig. 8



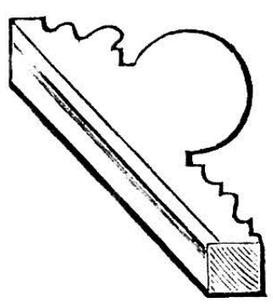


Fig. 5

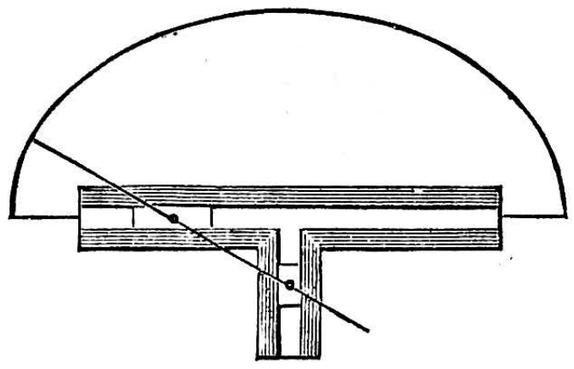


Fig. 6

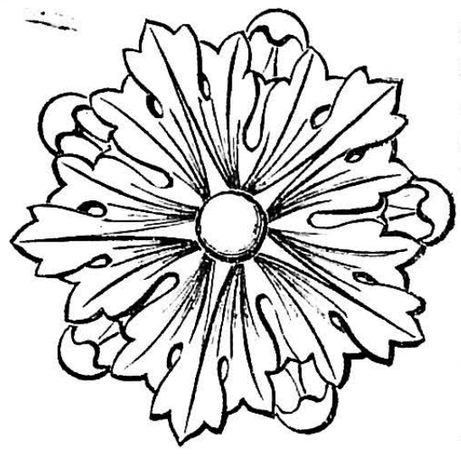


Fig. 9

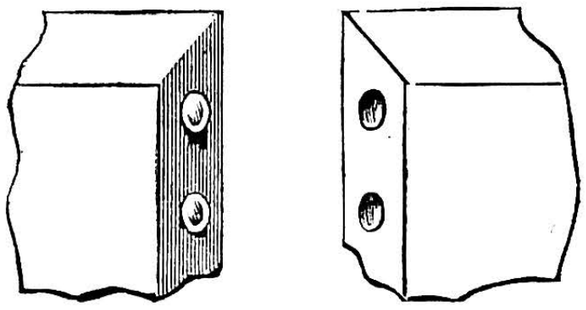


Fig. 11

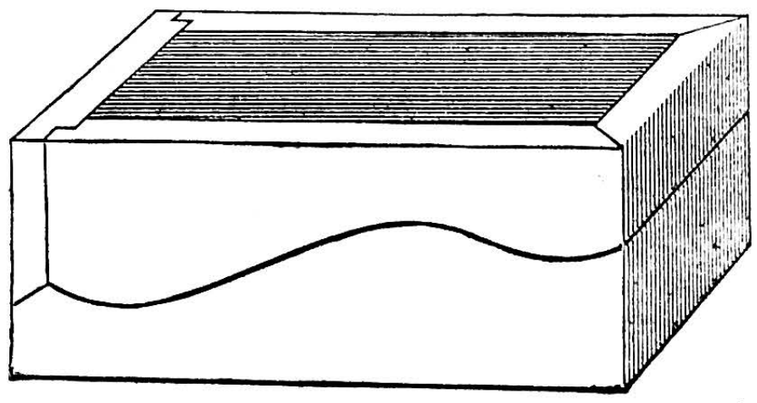


Fig. 10

Plasterers' Work. Fig. 5.—Cornice Mould. Fig. 6.—Trammel. Fig. 7.—Enrichments. Fig. 8.—Truss. Fig. 9.—Ceiling Flower. Fig. 10.—Piece-Mould. Fig. 11.—Piece-Mould Joint.

THE IRONMONGERS' AND ARMOURERS AND BRAZIERS' COMPANIES.

BY A FOREMAN PATTERN-MAKER.

With the increasing demand for the more complete technical training for our craftsmen, it is time the City Companies—the lineal descendants and representatives of the old craft guilds—should assert their old prerogatives in the changed conditions of modern industry. They ought to do much more than they are doing for the advance of that training in craftsmanship upon which our industrial supremacy mainly depends. Our craftsmen have not the same opportunities for acquiring skill in hand-work which they formerly possessed; and this, therefore, is a cogent reason why the factory system of minute division of labour should be supplemented, and its evil effects upon individuals corrected, by the encouragement of an increased taste for hand-work. For in hand-work, after all, and not in the automatic production of machine-made goods, lies true individuality and artistic craftsmanship. Our suggestions, in brief, are as follows:—That the Ironmongers, Armourers and Braziers, and other allied Companies, shall not confine their operations to London only, but shall include the provinces in one broad scheme of practical training for the iron-work trades. That local centres shall be formed in connection with local technical schools, managed by local committees, working in unison with the City Companies. That local exhibitions shall be held annually, and prizes and certificates offered, and that the work of the prize-winners from all local centres shall be selected, and again exhibited in London, and higher prizes offered for the best productions

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of the local prize-winners. In this way, London and the country towns will be brought into touch with one another, a generous spirit of rivalry will spring up among craftsmen who are at present practically as much sundered as though they lived at the Antipodes, and such a stimulus will have been given to artistic hand-work that will revive the best traditions of the mediæval ages, and do more to counteract the depressing influences of the modern factory system than any of the recognised labour movements of the time.

As regards the nature of the work to be done, it is clear that it must in all cases be work which can be done at home, without the aid of machines—that is, with tools and appliances operated by hand only, without the aid of motive-power. This puts whole classes of metal-work out of the category at once; but it would embrace light forging, light casting in brass, all model work, all repoussé work, work in bent iron, and all art iron-work suitable for lamp brackets, screens, grilles, hinges, locks, and almost all work in bent and hammered brass and copper, for domestic and ecclesiastical service. It would be advisable, perhaps, to give a wide range of choice of subjects to intending competitors in the field of design; yet, in some classes it would seem fairer to issue a design to be worked to—prizes to be given for the most perfect embodiment of that particular design. In the case of model work, for example, engines and other motors, and mechanisms might figure largely in the general class; but in special classes it would be well to confine competitors to the execution of small models in metal illustrative of, say, fundamental mechanical movements, kinematic chains, and the simple machines and motors. In this way a knowledge of the leading principles of mechanics would be combined with handicraft. Further, in this time of the development of the applications of electricity, models of the various types of dynamos and of installations of electric lighting might be placed in special classes for competition. So, too, boring small cylinders to micrometer measurements, and originating straight-edges and small surface plates, chasing screws by hand, filing cubical blocks, and so forth, somewhat on the lines of the competition for Whitworth scholarships, might be made matters of special competition. This would be fair and equal, because the question of design would not come in to complicate the choice of the judges in making awards for workmanship.

The expenses of such exhibitions would not have to be borne wholly by the Livery Companies. They could, however, do a very great deal. Vast potentialities lie in the Ironmongers' corporate, and trust income of £21,000, and in the similar combined income of £8,000 of the Armourers. But there is no doubt that the technical schools would be willing to accept a share. Public subscriptions would not be wanting, nor, perhaps, in time, grants of public money. Only in the incipient stages would difficulties present themselves. There is good work to be done in this direction; and none are so well fitted to take the initiative as the City Companies, with vested interests in the very heart of the empire, and with the traditions and *prestige* of centuries. Only those who are intimately acquainted with workmen have any idea how devoted these men are to the pursuit of hobbies. There is hardly a workman without his pet hobby. Here, then, is a fruitful soil for the City Companies to develop, to the advantage of the work-people themselves, and in the best interests of the nation. The Press should insist upon this.

COUNTRY CARPENTRY: A COW LODGE OF WOOD.

BY CHOPSTICK.

I HAVE commenced with a common cow lodge such as is to be found in every farmyard. Fig. 1 is the front elevation, showing the roof in skeleton—that is, before the tiles are on. It is built entirely of wood, except the quoins (A, A), which are brick, and the foundation walls (B, B), which are also brick: there are many lodges without even this, the posts being put into the ground, and the sills laid on the surface, but the better job is as here shown: brick foundations carried 2 ft. out of the ground for the sills to rest on, and brick quoins the same height to receive the bottom of posts.

As the roof of these buildings is usually framed on the ground at the timber-yard, I will proceed with that first. We never get timber long enough to enable us to get a piece 30 ft. long, so the first thing to be done is to splice the plates, or, as it would be called in some places, "scarf" them. The best way to do this is that shown in Fig. 3. I will suppose we are splicing the front plate, which is, or should be, 6 in. square. Before commencing the splicing, decide which is to be the top, front, or outside; the former should be a round side, and the latter a hollow side, for reasons which will be understood by everyone who has had any dealings with timber. This being decided on, we have a face to work from. We now take the iron square (shown in Fig. 5), and putting the long side, which is 1½ in. wide, level with the front, we make a pencil mark along it, then moving the square to that mark, we make another and then another in the same way, when the timber will be divided into four equal portions. This answers the same purpose as the mortise gauge does in setting out joiners' work. Each member of the splicing should be 4 in. long, which will make the whole length of the splicing 16 in., and, if properly done and pinned tightly, it will be very stiff and strong. But I am getting on too fast, it must only be fastened together temporarily, as a piece of oak 30 ft. long and 6 in. square would be rather an awkward piece to handle. I need not say anything about the back plate, as that should be done in the same way.

The next thing to be done is to mortise the front and back plates to receive the end plates, which is shown in Fig. 9, the piece at W being simply waste timber, which should be left on at present. Be sure and cut away at X in the tenon, and allow for same when setting out the mortises; these mortises and tenons will be set out with the square instead of gauges in the same way as described before. Having made the mortises and tenons at all four corners, put the front plate on some blocks so that it is perfectly straight; place the back plate in its proper position, and insert the end plates in their proper mortises, when, if they do not fit, they should be made to do so by saw-scarving the shoulders. I forgot to mention that a ¾ in. hole should be bored through each mortise before fitting together; this is for the pin. When the corners are fitted perfectly, mark the pinhole on the tenon with the same bit as it was bored with (this is called "pooking" it), and then knock them apart and bore the hole in the tenon a bit nearer the shoulder than the mark, which will, on the pin being driven in, draw them firmly together and make a good strong job.

All the corners and splicings being now pinned together temporarily, block the ring thus formed level and straight, and out of winding, and this being done, the next thing to do is to fit on the ties, L. I have shown the proper way to do this in Figs. 5 and 8, the former showing how to apply the iron square so as to get a good fit, and the latter showing the "corking," as it is called, cut, the shaded portions being cut out, and leaving a dovetail in the middle which can be marked on the plates. Both ends of the ties should be marked at once, as it is a great chance if they do not twist somewhat, but by striking with the square as shown, they will bed down perfectly even if they are 1 in. out of truth. The ends can be left to be cut off after the rafters are on. We have now the ring with the ties "corked" on, and will next frame the principal rafters.

First take a common rafter and set it out to the proper length; this is usually found as follows: if the roof is to be covered with tiles the rafters should be as many times 8 in. in length as the building is feet in width (if slates, 7 in. will do); thus the present building being 15 ft. wide, we must get our rafters fifteen times 8 in. long—that is, 10 ft.; but as this is the length from the backing or throat, we must allow another 6 in. for the foot. We now draw a rough sketch of the roof on a board, when it is an easy matter to get the proper bevels; the thickness of the backing is usually 1¾ in. We now cut two common rafters and try them as they will have to go, when, if they do not fit, they must be altered until they will. When this is the case, mark one for the model and cut all the others from it.

It is the principals only we will deal with now. Having got them cut, take a pair of them and lay them on the frame of the building with the feet in their proper place, and the tops resting on the tie; put a block between them at the top an inch thick to answer as the ridge or pitch-board for the time being, then take a "collar" (N, Fig. 10) and lay it on the rafters about half-way up, but be sure and get it the same distance up on both, and mark on the rafters for the mortises, and on the collar for the shoulder. These are usually put together with what is called a "bare-faced" tenon—that is, only one shoulder—and the collar being only 2 in. thick, while the rafter is 3 in., it will bring it right. The tenons should be cut to the shape shown in Fig. 10, as they are then easier to mortise and put together. Before putting together for good, cut the notches for the purlin, I, when the principal can be pinned together finally, and the other framed in the same way on top of it so as to get them both alike. The next thing to be done is to set the rafters out. First measure off half the width of the building at each end for the hips, then set out between so as the rafters come even distances apart; do this both back and front, and also on the pitch-board, M, which is usually a 1 in. board, then put up the principal rafters close to the ties as shown at H, Fig. 1; put in the pitch-board, and nail temporarily. Put up the common rafters which come at the end of pitch-board close to the hips, as at O (Figs. 1 and 7), also the "jack" rafter (P, Fig. 7); this is only a common rafter.

Having done this at each end, we will proceed to fit the hips (K, Figs. 1 and 7). To do this, cut off the corners as shown at R (Fig. 7), and hold the hip in its place and strike it; you will not get it right the first

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time, but do not cut it too short, and you will then manage it after two or three tries. When it fits properly, try if it will fit the other corners as it should do ; if so, you can cut the other three by it. The short rafters which come to the hips will require no explanation, as they only want cutting the same as the common rafters at the foot, and the right bevel to fit the hip at the top, but they should all be fitted and tacked up. The purlin can now be knocked into its place and fitted to the hips, and our roof is done so far. We have now to number every piece with red chalk before taking down. This is best done with letters, not figures.

as the back is framed in the same way, one explanation will do for the lot. First frame the plate E and the sill F to the posts C, C, C, then cut in the braces, and last the quartering, which should be mortised into the plate and sill, and nailed to the braces. I know it is the way in some places to put the braces in pieces, but that is decidedly wrong, and should never be done. The whole, having been fitted and numbered, can be taken to pieces again, and now we can put the building up in its proper place. This will require but few instructions, as it will be apparent to the most inexperienced that the sides must first be put up and then the roof. However,

also at the splicings. The end plates can now be placed in position and pinned to the front and back plates at the corners, and the frame of the building is safe.

Next get on the ties and pin to the teazle posts in front, and drive down into the corking at the back : this will fix the plates at the proper distance apart to receive the principal rafters, which should next be put on and fixed, and then the jack and hip rafters, all these being nailed both top and bottom. The quartering can be filled in at the back and ends, being careful to get the pieces in the right place according to their numbers, and also not to drive the plates up

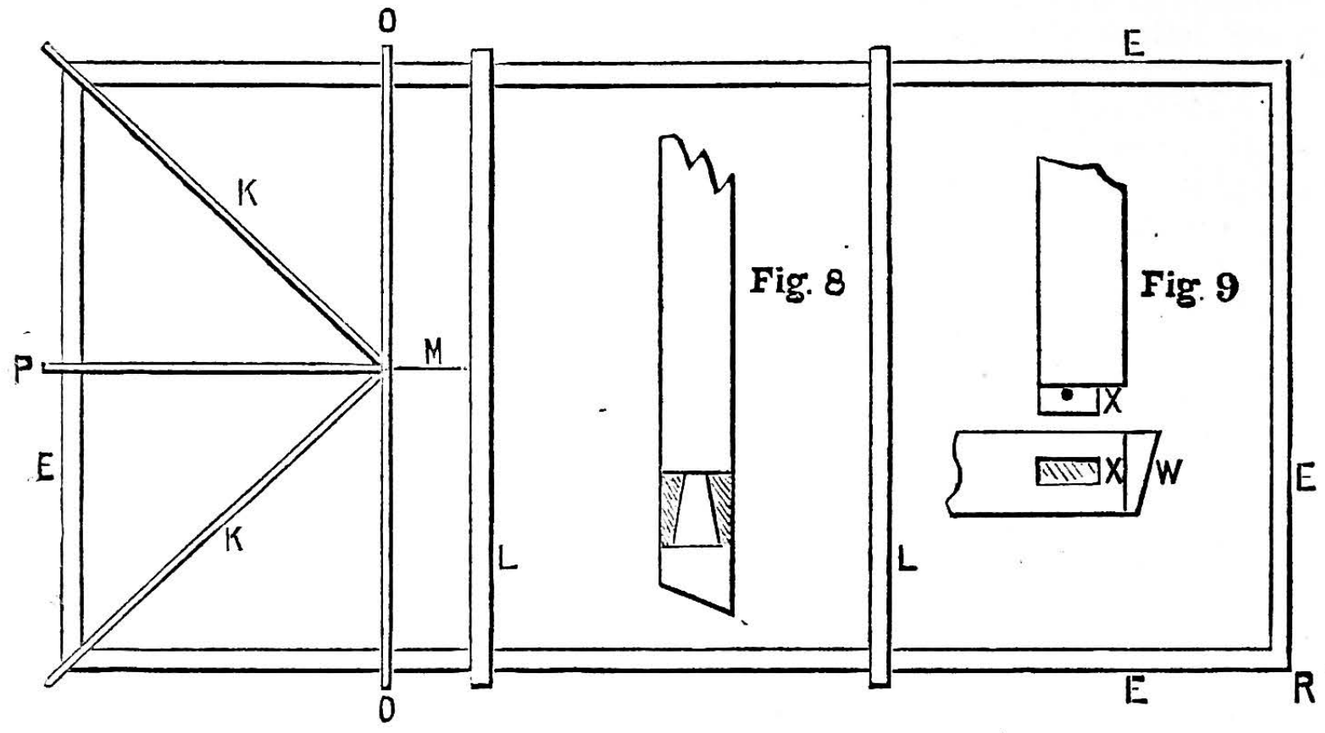


Fig. 8

Fig. 9

Fig. 7

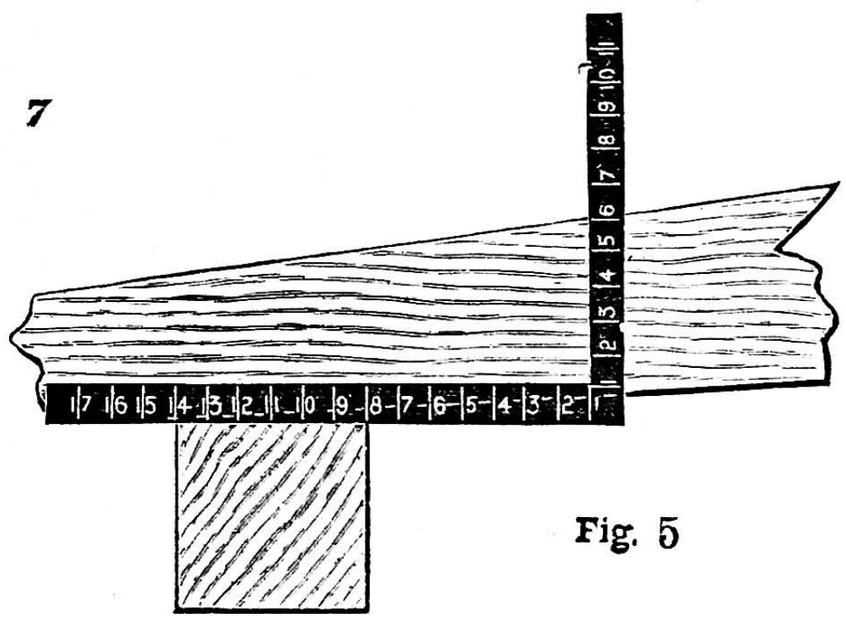


Fig. 5

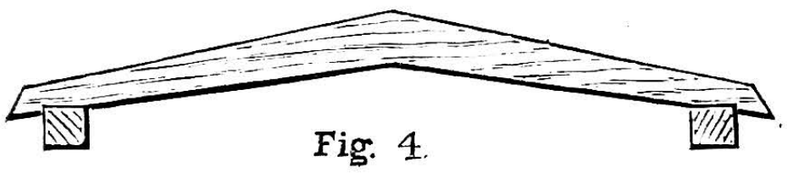


Fig. 4.

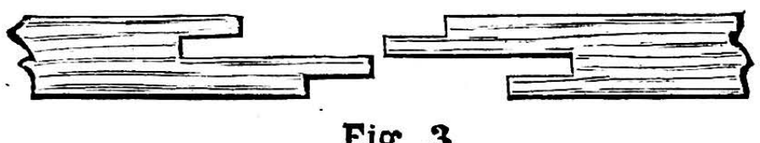


Fig. 3

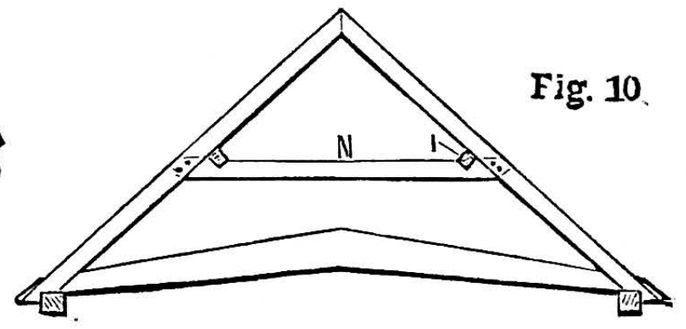
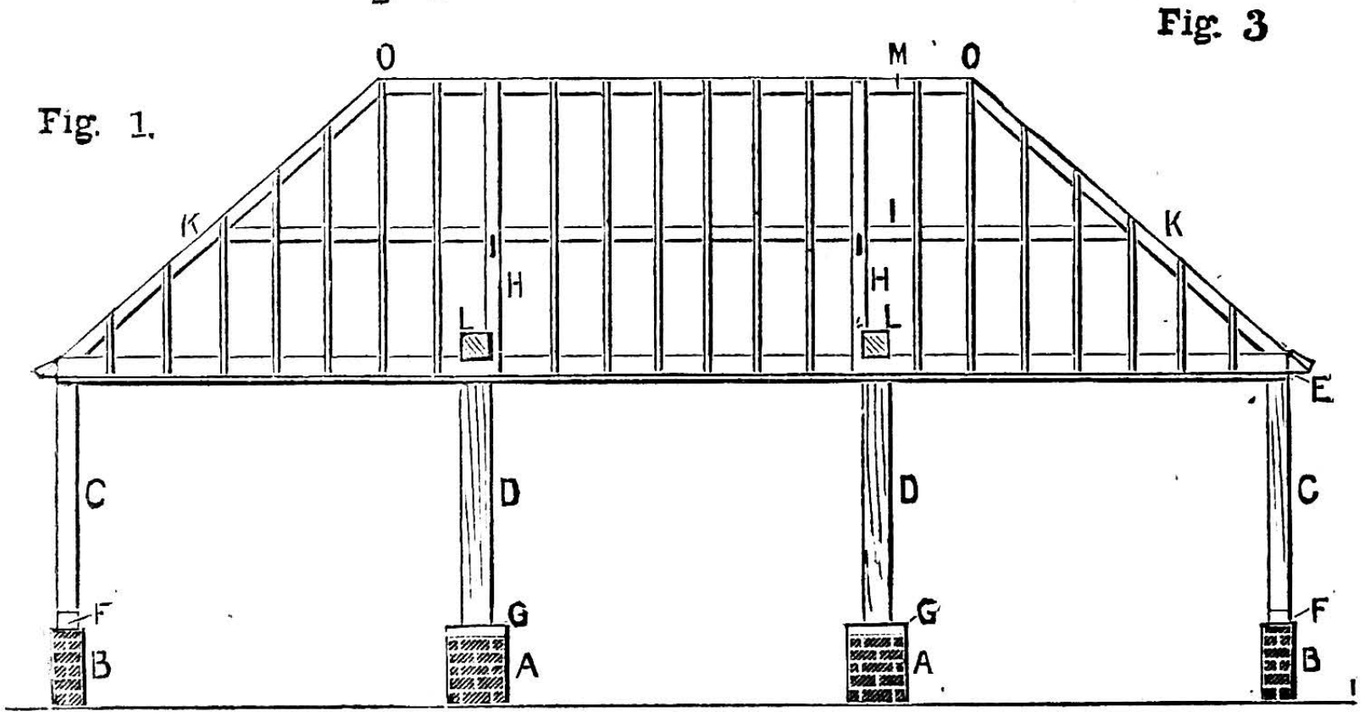


Fig. 10.

Fig. 1.



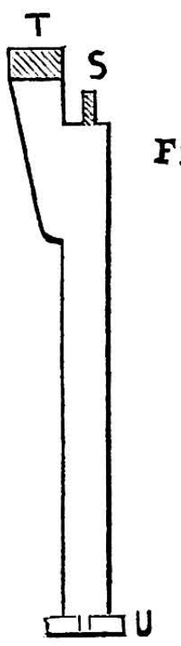
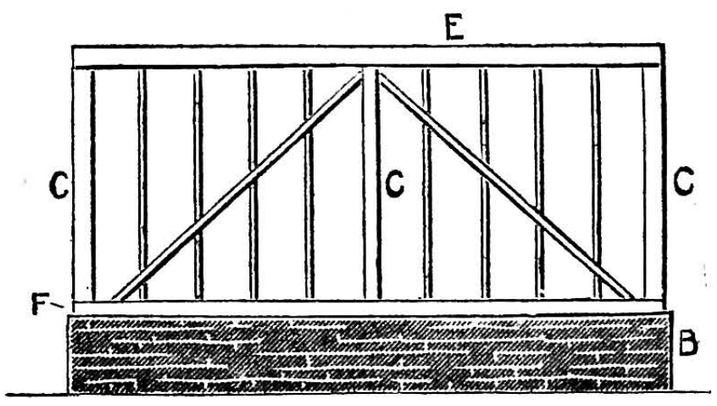


Fig 6

Fig. 2



Cow Lodge of Wood. Fig. 1.—Front Elevation. Fig. 2.—Elevation of End (Side Framing only). Fig. 3.—Method of splicing Front Plate. Fig. 4.—Method of fixing or "corking" Tie. Fig. 5.—Method of applying Square in fitting Tie. Fig. 6.—Teazle Post, showing Tenons. Fig. 7.—Plan of Roof Frame, showing Hips and Jack Rafter in Position at one End. Fig. 8.—Underside of Tie, showing "corking." Fig. 9.—Detail of Mortise and Tenon joining End and Front Plates. Fig. 10.—Elevation of Roof Principals. A, Front Quoins (Brickwork) ; B, Brick Foundations ; C, Corner Posts ; D, Teazle Posts ; E, Plates ; F, Sills ; G, Padding Sills ; H, Principal Rafters or Roof Trusses ; I, Purlins ; K, Hip Rafters ; L, Ties ; M, Ridge or Pitch-board ; N, Collars : O, Common Ratters ; P, Jack Rafters ; R, Corner where Hip comes ; S, Tenon to fit in Plate ; T, Tenon to fit in Tie ; U, Tenon to fit Padding Sill ; W, Waste End of Plate ; X, Haunching of Mortise and Tenon.

I will give a few examples of abbreviations when it runs to long numbers : for 30, instead of XXX. we make three strokes and cross them ; for 35, three and a half, and so on. All the numbering being done, the roof may be taken down, and the plates taken apart, and we will proceed with the "teazle" posts (Fig. 6). These go in front immediately under the ties, and the tenon, S, is to go into the plate, and the tenon, T, into the tie ; therefore to fit these it will be necessary to turn the ties over and put the plates on top of them, when they can be fitted and bored for pins as before. This being done, the padding sills can be mortised and pinned on the bottom of the posts, U (Fig. 6).

We have now to frame the back and two ends. I have shown one end in Fig. 2, and

I will explain in a few lines the best way to proceed. First, of course, the sills must be put in their place on the brick foundations ; sometimes they are bedded on in mortar, though it is not necessary, and for my own part I think it is best done without. The sills being in their places, and pinned together at the corners permanently, next put up the corner posts—these can be braced by two small slips of wood (tiling laths will do)—and when all four are up, place the centre posts in their mortises and put on the back plate, and pin same together at the splicings. Then pin the padding sills on to the teazle posts and stand them on their quoins ; prop them up with a common rafter or two, then place the front plate on them a piece at the time, and pin to the posts, and

in nailing the short quarterings. Next fill in the hips with the short rafters or strutters, and then the common rafters between the principals ; put on the eave-lath, and our lodge is finished ready for the tiles, which do not concern us. I omitted to mention that the purlins should be put in their places immediately after the principals are up.

I have described one of the better kind of farmyard buildings. There are many modifications of the same, but these instructions will enable anyone to erect any of them if called upon to do so. There are some in which the brick foundation comes to the surface only, and some dispense with it altogether, simply laying a brick here and there to keep the sills from the earth ; some are placed on wood stumps planted in the ground, and

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some (and these are the commonest of all) are formed by wood posts in the ground, and the roof chopped up out of chestnut poles. These last are often built by an agricultural labourer, and are usually covered in with thatch, but I have been called upon to build several in my time, though I trust I shall never have to do another as in common with most workmen. I am not fond of using the broad axe, which is the principal tool required in erecting this sort of building.

HOW TO MAKE A PHONOGRAPH.

BY WILLIAM DUFF.

DETAILS OF CONSTRUCTION—THE BASE—THE UPRIGHTS—THE SCREW SHAFT—THE CYLINDER METHOD OF CASTING—THE MOUTHPIECE—THE STYLUS—THE DIAPHRAGM—TURNING THE CYLINDER.

HAVING in the last chapter briefly stated the principles upon which the phonograph works, I will without further ado proceed to give details of construction, or, in other words, to tell the readers of this paper "How to make a Phonograph."

Let me say this, however, before starting: it will not be necessary to adhere strictly to the sizes which I have given. The reader, if he decides to make one, may make it any size he pleases, but each part must bear a certain relationship to surrounding parts. For instance: the needle must be fixed so as to touch the cylinder, and be capable of adjustment; the cylinder itself must have sufficient space between the uprights to travel backwards and forwards in. So I would advise you to set out every piece full size before commencing the work of construction.

Fig. 1 (see WORK, No. 167, page 164) is a front elevation, with the mouthpiece and diaphragm removed. Each part is lettered, and is of reduced proportions to one which I have made. A is the base, which should be made of good stuff, with a drawer in the bottom in which the blank phonograms may be kept. The size should be 15 in. × 7½ in. × 2¾ in. The mouldings of the drawing may be copied, as they look very well, and answer the purpose admirably. B, B, are the standards or uprights. They should be made of inch-stuff; their shape and size will be seen at Fig. 2. Make two pieces, then, like Fig. 2, and fit carefully two small pieces of the same stuff, like Fig. 3. After they have been carefully fitted together, fasten the small piece with two screws, as shown in Fig. 4, and then with a ¾ in. bit bore a hole in each, taking care to have the hole in the position shown in the figure. The holes are the bearings for the shaft. This completes the standards, and they may be placed in position upon the base, and fastened with screws passing from underneath. They should be not less than 10 in. apart, and about ½ in. from the front of the base. C, in Fig. 1, is the top, and is simply a piece of wood, like the standards, 12 in. × 3 in., with a hole 1½ in. bored in the centre. It is hinged to the standards, as shown at F. Two brass knobs, shown at G, may be put at the corners. These serve a twofold purpose: they look ornamental; at the same time, they act as stops to prevent the mouthpiece from knocking against the cylinder when the phonograms are being placed upon, or removed from, the cylinder. The shaft, D, is a rod of ¾ in. iron or steel, 17 in. long, one end of which is tapped not less than 5½ in. The pitch of the screw should be about fourteen threads to the inch. The success of the instrument depends in a great measure upon the accuracy of the shaft; so, unless our amateur is well up in lathe manipulation, I would advise him to get this made by a practical man. I got mine made by an old friend who takes a pride in doing such work, and a finer piece of work I have never seen. After the shaft has been made as directed, two small holes should be drilled in it at right angles to each other, about the centre, or 7 in. from the screwed end. Two nails, or pins, are passed through these holes when the cylinder is being cast upon it, to prevent the possibility of the cylinder turning round upon the shaft. This will be seen at Fig. 10, where a piece of the shaft is shown with the nails in the holes. The cylinder (marked E in Fig. 1) is made of plaster-of-Paris. It is 4 in. in diameter and 4½ in. long, and, as already indicated, it is cast upon the shaft. To do so, a mould will be required. This may be made by a tinsmith, or an old meat-tin may serve the purpose, but the plan which I adopted was as follows: I got a round piece of wood 4¼ in. in diameter, with a hole in the centre to allow the shaft to pass through, and then I took a piece of pasteboard, and made a tube by bringing the two ends together and gluing a strip of stout paper on the outside at the join. I then tacked this to the wood. The inside measurement was 4¼ in. × 4¾ in. This mould was a complete success, and saved the trouble of getting a tin one made.

The next thing will be the casting of the cylinder, and if you have had no experience in using plaster-of-Paris you need not be disappointed if the first attempt is a failure. However, "never venture, never win." Get 14 lbs. of the best—"well-boiled," I think, is the builder's term—and before mixing with water place the shaft in position in the mould. First pass the nails or pins through the holes as before-mentioned, and pass the shaft through the hole in the wooden bottom. The top of the mould should come flush with the ending of the screwed part of the shaft—*i.e.*, 5½ in. from the end and the bottom 7½ in. from the other. The shaft must be rigidly fixed in this position, and perfectly central from the side of the mould. When all this has been arranged satisfactorily, mix the plaster with water in a large wide-mouthed vessel, such as a wash-hand basin, stirring all the time, to prevent it getting lumpy, to the consistency of Nestle's Swiss milk or pancake dough.

When this has been done, pour it carefully into the mould, and wait patiently for it to set. Do not hurry this process in any way. In the meantime, you can be getting on with something else.

At Fig. 5 is shown a small piece of brass, which is to act as a guide for the screw. It is made from sheet brass $\frac{1}{16}$ in. thick, and shaped as shown, and must fit nicely in the thread of the screw of the shaft. Two small holes are drilled in the corners of it, through which pass two small screws to fasten it in position in the inside of the left-hand standard. It is indicated by the dotted lines in Fig. 4. The mouthpiece, or funnel, may now be prepared; it can be turned from a piece of wood 3½ in. × 1½ in. square. Fig. 7 explains this fully. For the stylus, or needle, a large-sized sewing-needle about 2 in. long may be employed. Soften it by heating to redness, and allowing it to cool gradually; nip off the eye, and tap a fine thread upon it for about ¾ in.; make two small nuts, tapped inside to fit the screw on the needle. This done, bend the needle twice at right angles, and then turn down the point. It, when complete, should look like Fig. 8. Now get a small block of wood or cork, about ¾ in. × ½ in. square; bore one hole right through from side to side, and another in the bottom about ¼ in. up. Make or buy a small brass screw with a flat head, and a square nut. Fasten the nut in the wood or cork by first sinking it in flush, and then putting a drop of glue or cement of some kind to keep it in its place; put in the screw, which must have plenty of room to pass upward, if required: this is for adjusting the pressure of the needle upon the cylinder. Run one of the nuts upon the needle as far as it will go, and pass the screwed end through the hole in the block; put on the other nut, and fasten up. Before putting the needle in the block, it will be well to re-temper it, and it will be advisable to flatten it out a little where the adjusting screw touches it.

This completes the needle and its mountings. The diaphragm is simply a thin circular metal plate, about 2¼ in. in diameter. It may be made from photographer's ferrotype or the bottom of a Swiss milk-tin. Whatever it is made from, it must be perfectly flat, with no buckles round the edge. The block carrying the needle should be cemented to the centre of the diaphragm with melted shellac or Carter's liquid glue.

Now, by this time I fancy the cylinder will be as hard as ever it will be, and will be ready for truing up. This can be done in a turning lathe; but if you have not such a useful tool in your possession do not despair, for it can be done in its own frame. I presume you have the standards fitted to the base either by screws or tenons, and the fly-wheel with handle fitted to the shaft. By all means have a fly-wheel, and let it be solid, as this helps greatly to ensure a uniformity of speed when rotating the cylinder. A fly-wheel from a hand sewing-machine, with the handle attached, might be used for this purpose. This being arranged, take out the screws from the small pieces (Fig. 3) in both standards, and place the shaft in its position. See that the small brass plate catches the thread of the screw. Replace the pieces, and screw them up tightly. Turn the handle, and you will find that the cylinder while rotating will travel endwise until stopped by the standard. Reverse the motion, and you will find that it will travel back until it reaches the other standard.

If you have been reading carefully, you will have observed that I allowed ¼ in. when casting the cylinder for truing up. The ends should be done first; they will not want much doing. Take a long-bladed knife—such as a table-knife—and hold the edge against the cylinder; turn the handle, and by this means you will be able to scrape the ends nice and smooth, and square. The turning of the face will be rather more difficult. Get a small turning chisel, pass it through a cork, and fix it fast in the hole of the top, C (Fig. 1), and allow it only to touch the cylinder lightly; on turning the handle, the cylinder will, of course, travel underneath the chisel, and the chisel will perform its part with precision. The cylinder must be turned backwards and forwards several times, as the chisel must only scrape the surface. A little patience and care are necessary at this point, as the plaster is very easily chipped and spoiled. The hinged top will be a help in regulating the pressure of the chisel.

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PATENTS AND PATENTEES.—On the 14th of July last the President of the Board of Trade announced in the House of Commons, that "The country ought not to look upon the Patent Office as a permanent source of income," and that "it should be considered whether a reduction might not be made in the fees on Patents charged in the interval between four and eight years, so as to extend the cheap protection now given for four years to a longer period." It is gratifying to find that the Chancellor of the Exchequer in his Budget, which he introduced on the 11th of April, announced that on the 20th of September next a reduction will be made in the Renewal Fees, and that they will stand at £3, £6, £7, and £8 respectively; the fifth and sixth years will be £9 and £10; and after that they will be £11, £12, £13, and £14 a year respectively, and stated that it is "a reform the Government does not wish to delay." It is to be hoped that the Government will see "in the interests of the poorer patentees, and also of the further development of invention," as Mr. Goschen expresses it, that the present outrageous charge for a Patent ought to be brought within reasonable bounds, and that the grant should be obtainable for the sum of £10, of which £2 should be paid on application, £3 on the filing of the complete specification, and at the seventh year the other £5 should be paid if it is intended to keep the Patent in force. This reduction would, in the words of Mr. Goschen, "give extreme satisfaction to an extremely large class," and, moreover, conduce in no small degree to the "interests of the poorer patentees, and also of the further development of invention." He also stated that, "with regard to Patents, the new ones taken out after the 30th of September would enjoy the diminution of fees, but he would make a statement later on as to whether Patents taken out between the end of the financial year and that date should enjoy the same advantage." We quite agree with the remark of the President of the Board of Trade, that "the country ought not to look upon the Patent Office as a permanent source of income"; and seeing that the Patent Office is neither more nor less than a Record, or Registry Office, of all that has been, is being, and will be done in Inventions and Patents, is kept up entirely at the cost of inventors and patentees, without asking for the expenditure of one penny from the Government, it is very certain that so long as the sums paid by inventors and patentees meet the cost of maintaining the establishment, that is all that can reasonably be required. We hope that the increasing intelligence manifested on this subject will lead to the result we have mentioned, and remove the reproach that in Great Britain more is charged for an inefficient grant than in any other civilised country, and that the Government will see that this is a reform they should *not* wish to delay.

ENGLISH COUNTY ART.—The Hertfordshire Society for the Promotion of Art has set an example which other counties would do well to follow. Its object is "to encourage and develop art throughout the county," among all classes, and in every direction. It holds an exhibition yearly in each of the chief towns of the county in rotation, at which prizes are offered for drawings and paintings, for all kinds of wood carving, inlaying, fretwork, hammered and bent iron, embossed leather, and other branches of decorative art. The chief feature of these exhibitions is that the exhibitors are allowed to hear, through their local secretaries, the opinion of the judges on their individual work, or, if at the exhibition, may solicit and obtain criticisms from the judges themselves, which must be very helpful, and will also remove the cause of sore feeling and disappointment apt to be generated on such occasions, when exhibitors find the work they and their friends have considered absolutely beautiful passed over or condemned. In the eyes of a connoisseur such work is often, through its lack of art, "a monument of misplaced energy"; but if the faults are pointed out to the worker, and this energy turned in a different direction, the failure of one year may be followed by the brilliant success of the next. The Society is composed of two divisions, the first consisting of members and associates who subscribe 5s. yearly, the second of artisans who pay 1s. a year, and equally rank as members and associates. Only those belonging to or "connected with" the county of Hertfordshire can belong to the Society, but the condition for honorary membership is wide. Honorary members only need to be "persons interested in art." A wide latitude is also allowed in the matter of artisans' exhibits. The schedule informs them that anything they may have made, even if not included in the prize list, may be entered for competition if it "partakes of the nature of art," and is accepted by the exhibition committee. A special prize was given, for instance, in 1891 for heraldic painting, and in the first exhibition of the Society, held in Hertford in 1889, for some walking sticks with quaintly carved heads, cut by a working man at home. The committee of the Society received a grant of £1,500 from the County Council to enable them to carry on technical education in the villages, which they are doing with great success. The third exhibition, for 1892, is to be held at Watford in October. There is no reason whatever why every county in Great Britain and Ireland should not have a similar society for the promotion of art.

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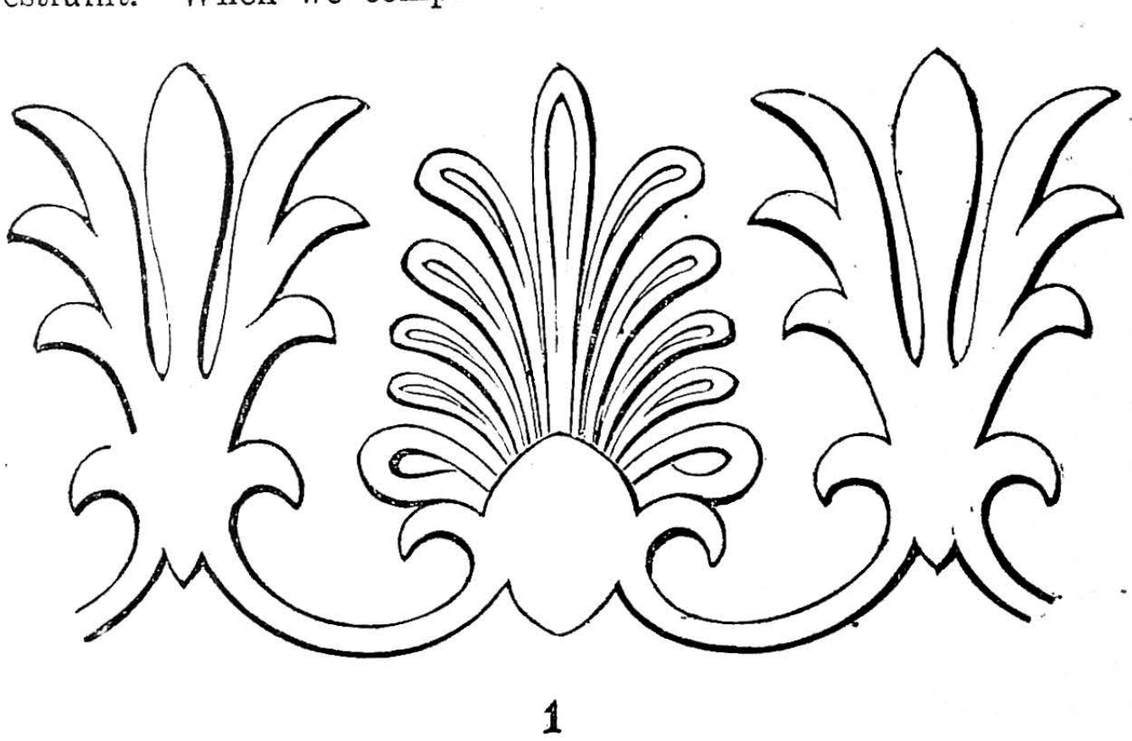
DESIGN AND DECORATION OF ALL AGES.

BY M. H. C. L.

GREEK.

THE chief characteristics of Greek art, the characteristics which have made it the inspiring principle for the art of the whole civilised world, are harmony, proportion, and restraint. When we compare Greek decoration, especially at its best period, with savage or Oriental decoration, the contrast is very striking. That remarkable instinct of perceiving the fitness of things, and avoidance of all excess which pervaded the Greek genius, is nowhere more marked than in this particular branch of art. Instead of covering the whole surface of an object with a crowded variety of ornament, the Greeks understood the beauty of plain spaces, and so applied their decoration as to give an effect of simple grandeur in the aspect of the whole, while the ornament itself, without obtrusively distracting the eye, gained in value by the sparingness of its use. When the Greeks decorated a moulding, the ornament followed the moulding, and its shape was that of the section of the moulding—a rule from which the less artistic Romans departed, so decorating their mouldings that the form of them was lost, to the ruin of the general effect.



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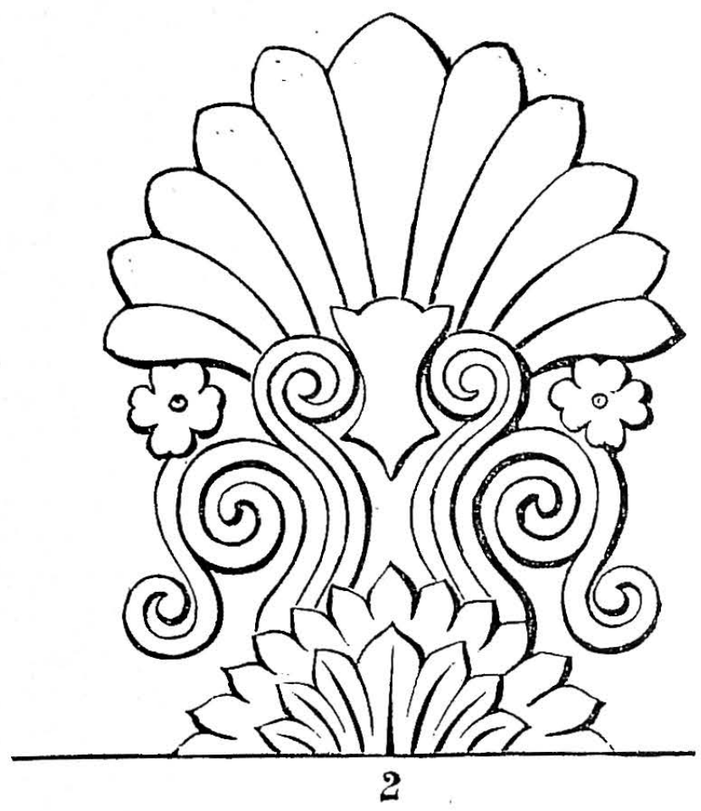

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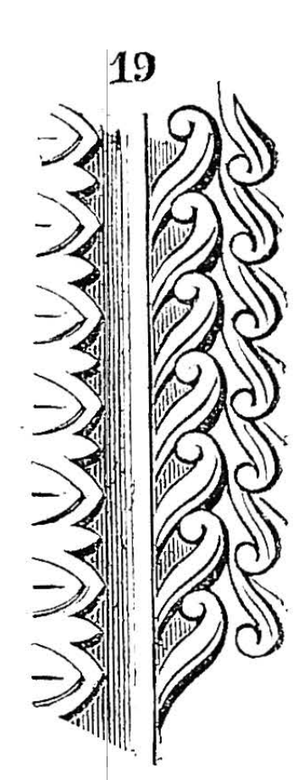

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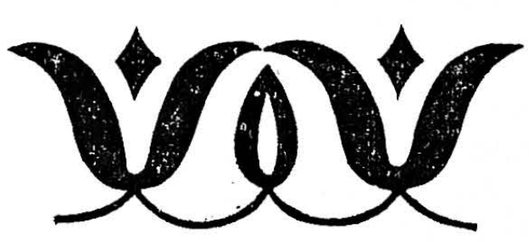

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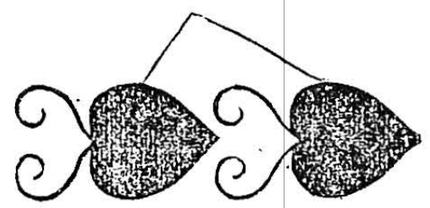

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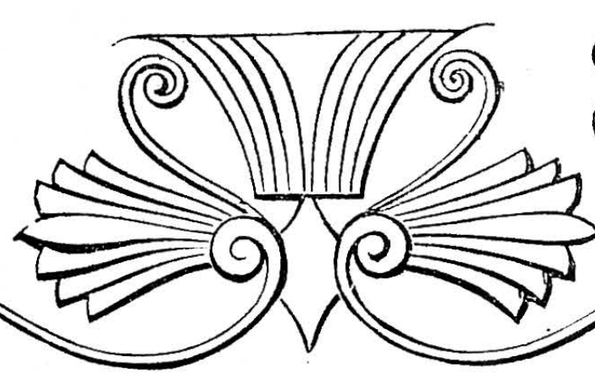

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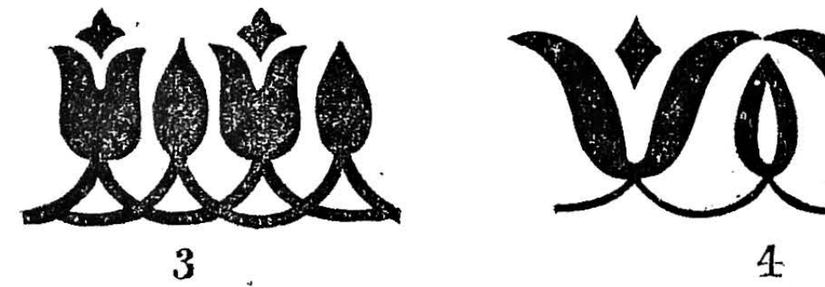

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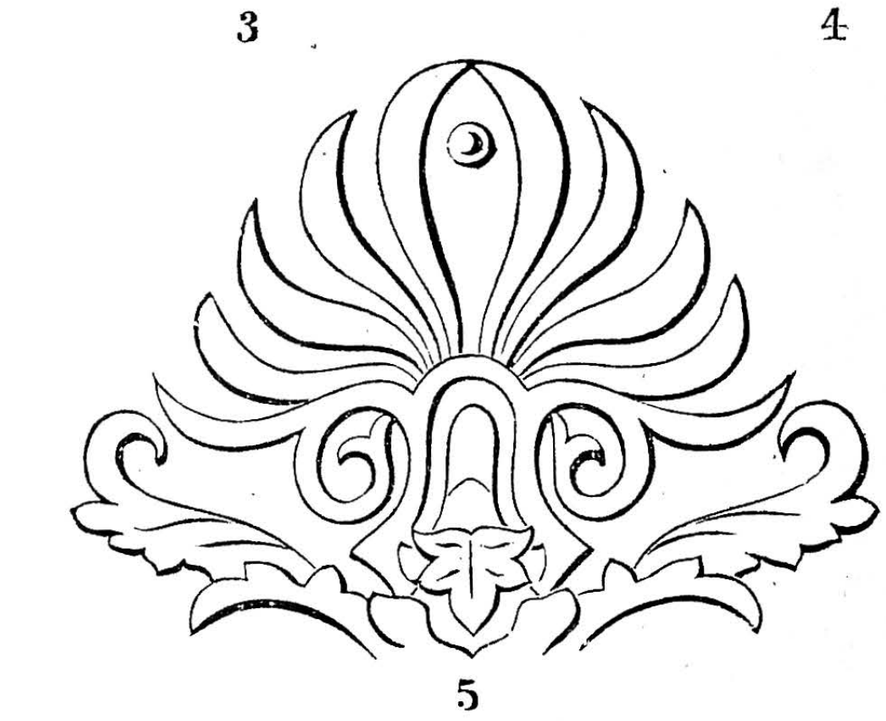

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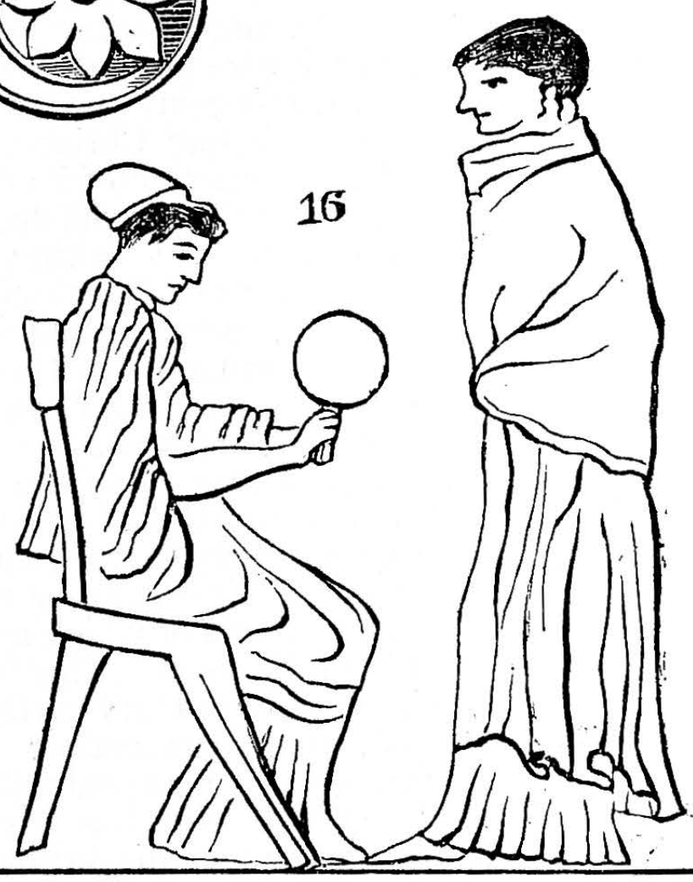

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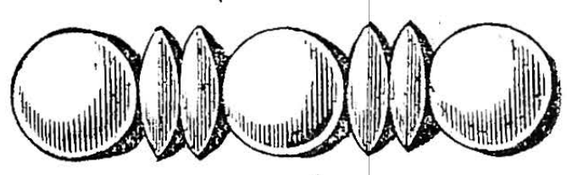

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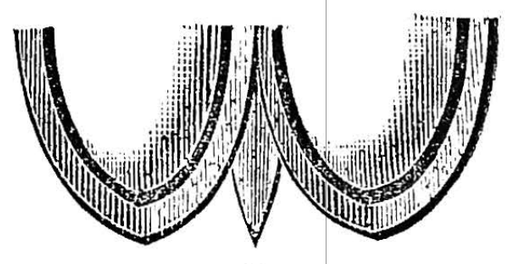

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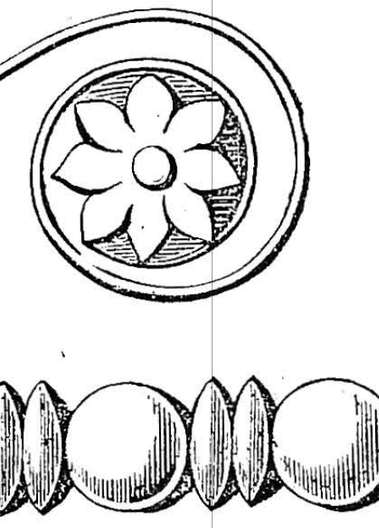

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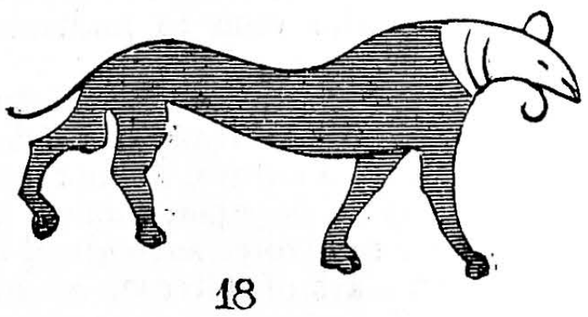

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Greek Ornament. Fig. 1.—Necking of Ionic Column, from East Portico of Erechtheum. Fig. 2.—Athenian Artificial Ornament. Figs. 3 and 4.—Decoration on Terra-Cotta Vases. Fig. 5.—Ornament on Stele. Fig. 6.—Leaf on Corinthian Column of Temple of Artemis at Ephesus. Figs. 7 and 8.—Egg and Tongue Mouldings. Figs. 9, 10, 11, 12, 13, and 14.—Varieties of Fret Pattern. Fig. 15.—Suastika. Fig. 16.—Figures on Vase, best Period. Fig. 17.—Border from Vase, Black on Red. Fig. 18.—Asiatic Animal from Vase, Transition Period. Fig. 19.—Part of Door Jamb from the Erechtheum. Fig. 20.—Ornament from Capital of Column, Temple of Artemis Eucleia at Athens.

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The Greeks, aiming at perfection, delighted most in delineating nature in her most perfect development, the human form. Their earliest efforts at art were in this direction, and the forms of the vases found at Mycenæ, which dated back to a semi-barbarous age long before the first glimmerings of Greek history, are rough imitations of human figures.

The objects of metal-work vases, etc., found at Mycenæ, are among the most antique specimens of really artistic Greek work we possess. The decorations on these consist of spirals, floral rosettes, the foliage of water plants, and representations of insects and marine animals: curves and bent lines are almost exclusively employed in these designs.

In the next period of Greek art, an Oriental influence has crept in, partly by means of Asiatic traders, but principally through the agency of the Phœnicians. The Phœnicians were too cosmopolitan to produce any very distinct style of their own, though they were among the most skilful craftsmen of old days. But they were in direct communication with various nations having a distinct art of their own, and these distinct arts they copied themselves and introduced to each other. They traded with Egypt and Assyria, and through them the two great schools of design, if one may so term them, helped to mould the early art of Greece. The ξόανα, or wooden images of gods which were the first efforts of Greek sculpture, were, Pausanias says, Egyptian. Greek architecture was largely influenced by that of Egypt, which, in the time of Psammetichus, was directly opened to the Greeks, and in the Doric column we find the influence of the massive columns of the Egyptian temple.

Assyria had, however, a far greater share in the development of Greek art. In Ionia the artistic tradition was distinctly Assyrian. The designs were, in many instances, identical, the human figure was presented in the same form: sphinxes and animals, possible and impossible, such as we have become familiar with on the Assyrian monuments, made solemn processions, in zones one above another, on the archaic Greek vases. The Assyrian guilloche became a favourite Greek border, and the honeysuckle, sometimes called "palm-leaf" decoration, though probably derived neither from one nor the other, but from some simple many-petalled blossom, came directly from Assyria. This design became one of the most characteristic forms of Greek ornament (Figs. 1 and 2). They added lightness and grace to the original, and allowed a certain amount of variety in its application.

The lotus flower was another form borrowed from Assyria. Figs. 3 and 4, from antique Greek vases, are borders evidently representing the lotus bud and flower, interesting both in their likeness to and difference from the Assyrian treatment of the same subject.

In Fig. 2, an artificial ornament from the Erechtheum at Athens, we have the palm-leaf treated in a very Assyrian way. The spirals at the base recall the blossoms of the "sacred tree," and the rosette at each side comes from the same school of art.

Fig. 5, a similar ornament, combines the palm-leaf with the acanthus, the foliage of which gave such a happy inspiration to Greek art. Fig. 6 is a leaf from the capital of a Corinthian structure in the Temple of Artemis at Ephesus: a perfect acanthus leaf is placed behind it. The treatment of foliage reached a greater perfection than it had yet attained in the Greek representation of the acanthus, in which the characteristic beauties of natural foliage were all reproduced in graceful curve and harmony of light and shade, without a taint of the feeble prettiness and suggestion of attempted deception which clings to naturalistic treatment.

In Figs. 7 and 8 two varieties are given of the "egg and dart," or "egg and tongue" border which we all know so well. The roundness of the egg as opposed to the sharpness of the dart, one set off against the other, and affording an unobtrusive combination of contrast in parts with completed harmony, was in accord with the Greek law of balance and proportion. While Corinthian capitals were extensively decorated with acanthus leaves, the egg and dart and the palm-leaf ornament were much used on the capitals of the Ionic columns, as this ornament accorded well with the curves of the volutes and the roundness of the base.

In the treatment of animals, as, for instance, in the Lion Gate of Mycenæ, and in the representation of mythical figures, frightful and monstrous, and in the form of some of their divinities, in some of the old Greek work, the influence of Asiatic art is visible. A noted specimen of this is the decorated or carved and inlaid chest of Cypselus of the seventh century before Christ. On this chest, together with other Oriental designs, Artemis is represented winged, and holding a lion and a panther in her hands, as she is depicted in Persian mythology. The vases of the seventh century bear the same trace of Asiatic influence. It was just after this that Greek art began to throw off foreign elements and develop its individual life.

The development began in Oriental, and soon spread to European Greece. Great workers in bronze arose, architecture sprang up, and sculpture in marble took the place of figure carving in wood. It was in the fifth century before Christ that Greek art reached the perfection of its development.

A very large part of the decoration of the Greeks was, strictly speaking, pictorial. The beautiful legends of their religion provided them with the metopes and the continuous friezes which ornamented their temples, for the paintings on their vases, and the engraving of their gems.

Religious processions were sometimes represented, such as that which took place at the yearly Panathenaic festival, which formed the subject of the frieze running round the Parthenon, fragments of which may be seen in the British Museum. This frieze is said to have been designed and partly executed by Pheidias, the great master of sculpture. About the same time were built the Theseum, the Temple of Wingless Victory, and the Erechtheum, under the brilliant auspices of Pericles. Sculpture, which went hand in hand with architecture, was also at its zenith, and it is the works of art of this period which should be especially studied by those who wish to understand the Greek genius.

Architecture and sculpture proper, as distinguished from bas-relief of a purely decorative nature, do not come within the scope of this paper, though it is impossible really to divorce such allied branches of art.

The art of Greece, as of every nation which has any true art, was in a great measure religious. It was in the temples that the exquisite bas-reliefs were carved, and the temples which had for their support the columns of the three orders. The private houses of the citizens were in nowise ornamental. The temples and the theatres, where the great productions of the Greek dramatists were performed as a religious ceremony, were buildings in which every freeman felt he had a share, and on which he concentrated his pride. The houses of the dead, however, were considered worthy of ornament. A monument or *stele* was placed over the place of burial, on which were carved such scenes as the farewell of the dead person with his friends, the funeral banquet, evidently an importation from the religious rites of Egypt, since we are told the funeral feast was supposed to benefit the dead himself. In the decline of Greek art the influence of Egypt was dominant, as in the decline of Egyptian art the Greek. Scenes from the life of the deceased while still on earth were also depicted, members of his family, and even favourite animals, being introduced. The simpler of these stelæ were surmounted with such a decoration as is shown in Figs. 2 and 5.

Marble tablets offered to Asclepius and Hygeia for recovery from sickness were also decorated with bas-reliefs, generally containing portraits of these deities. There were besides political tablets, with allegorical subjects representing episodes connected with the State. The Greeks, under the inspiration of Egypt, with its scarabs (*i.e.*, carved gems in the shape of a scarabæus), and Assyria and Babylon, with their cylinders, became famous for the engraving of intaglios. The intaglio, as, perhaps, it is superfluous to mention, is the exact opposite of the cameo, and was a favourite subject for Greek art. The design is sunk instead of raised, and an impression may be made from it in wax as with a seal. As seals the intaglios were generally used. The subjects engraved on them were chiefly mythological, and some of these still existing are of great delicacy and beauty.

The Greeks excelled in metal-work. From early times they made large use of bronze, and their repoussé work in different kinds of metal had evidently attained a high degree of perfection in Homer's time. The Iliad and Odyssey are full of descriptions of minor art work—spinning, weaving, and embroidery—as practised by the highest ladies of the land, and metal-work in the shape of beautifully ornamented armour, and gold and silver cups and bowls, though the latter were chiefly of foreign workmanship. The wrought silver cup given by Achilles as a prize was wrought by the ingenious Sidonians, "and Phœnicians had carried it over the shadowy sea." The shield of Achilles may have been like the automatic gold handmaids of Vulcan and the golden wheeled tripods "that went of their own accord" the vision of a poet's fancy, but the method of its production is described circumstantially as by one well versed in the craft. The much variegated necklace of gold set with amber like as the sun, given to Penelope by Eurymachus, is another instance taken at random from the Odyssey.

Among the most characteristic productions of lesser Greek art were the terra-cotta plaques, and more especially vases, with which three rooms in the British Museum are filled. Some of the most archaic date from the era of barbaric art: the decorations are of the roughest, but among the oldest of them we find the beginnings of the pattern which bears the distinctive name of "Greek," technically "fret," several varieties of which from these vases are given in Figs. 9, 10, 11, 12, 13, and 14. The "Greek

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pattern" is founded on the "Suastika," Fig. 15, a mystic sign of great antiquity, said to represent in its short arms Time, in its long ones Eternity. It is an emblem we come across again in Eastern and in Scandinavian art. It is probable, however, that the Greeks simply used it decoratively, as they did certain other symbols, without knowledge of its hidden signification. The volute was also early popular, the most beautiful application of it being the design called the scroll pattern, which Morris takes to have originated in a conventional representation of the waves of the sea. The Assyrian influence is very strongly marked in the decoration of the early Greek vases. In looking at them one might fancy oneself examining a new discovery from Nineveh. In the second period the ornamentation was in black on the red ground of the terra-cotta. In the third and most perfect period the subjects were left red and finished with delicate black lines, while the background was painted black.

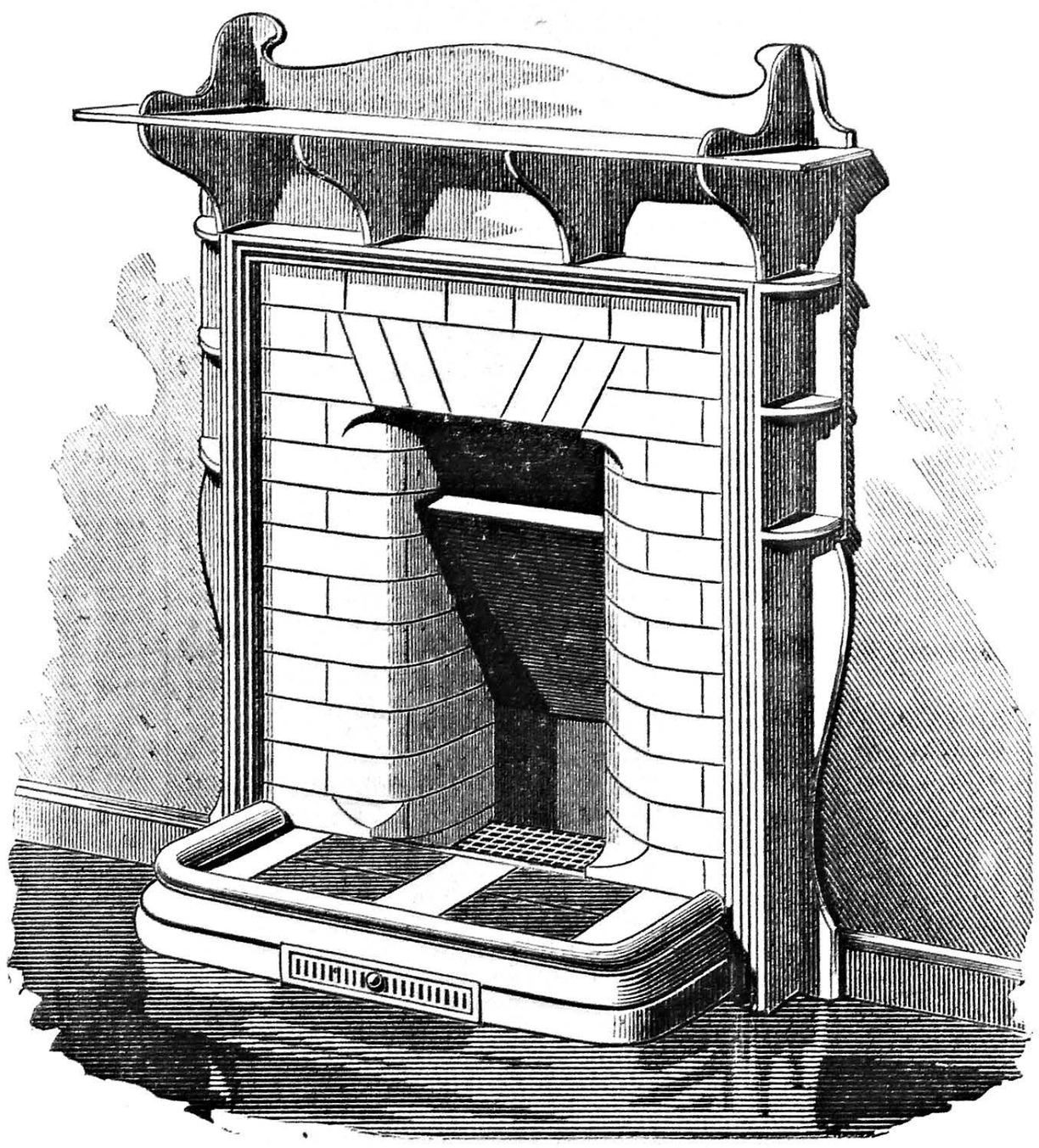
A variety of colouring and style marks the latest period. The specimen given (Fig. 16) is from the best period. The woman holds up a mirror, one of those probably taken originally from Egyptian models, which formed the subject for some of the most beautiful metal-work on a small scale which Greece has bequeathed to us. The handles, in the form of human figures, etc., were often works of consummate art. Among the Greeks, beauty and utility went hand in hand: every man was an artist. In the words of Maxime Colignon (Wright's translation, which has been a great aid to me in the study of Greek art): "In a people, the most artistic that has ever existed, the humblest works recall the traditions of the grand style. Art and trade were not strictly divided, and in his limited domain the painter of vases could attain or maintain a certain independent individuality."

SOME GOOD THINGS.

"Workshop Receipts for Manufacturers, Mechanics, and Scientific Amateurs." Fifth Series. (E. & F. N. Spon.)—This useful book is not merely a collection of receipts, as its name would seem to imply. Within the compass of 432 pages there are several long articles on laboratory apparatus and practice—desiccating, evaporating, distilling, filtering, etc. A paper on the magic lantern occupies 30 pages; electric batteries, motors, welding machines, etc., take up 84 pages; and several pages are taken up in describing the processes of stereotyping, modelling, pipe-making, netting, boat-building, etc. These papers are extracted from various sources, most of which are acknowledged, and the book is freely illustrated.

Electricity. — "Electro-Platers' and Metal Polishers' Handbook."—We have received from Messrs. J. E. Hartley & Son their illustrated catalogue and price list, issued under the above title. It contains information likely to be of service to electro-platers and metal polishers.

New Fireplace.—The value of fire-brick in connection with the burning of fuel is now acknowledged by most people. The Front-Hob Fireplace is constructed entirely of fire-brick, with the exception of the grate-bottom and the ash-pan, which could not well be made of any other material than iron. The fuel, therefore, is surrounded on all four sides by fire-brick; even the front consists of a fire-brick slab about 3 in. thick, laid with its edge to the fire, thereby forming a raised hearth or hob, which absorbs heat, and then radiates it out into the room. This fire-brick front prevents the cold blast of air from coming to the front of the fuel, which, in the ordinary fireplace, either chills down and blackens the exposed surface of the coal, or makes the fire burn too swiftly. Sufficient air to keep up combustion and a bright fire comes over the hot surface of the front hob, striking the fuel on the top. This regulation of the supply of air to the fuel has many advantages. It makes



Front-Hob Fireplace.

the fire burn more slowly, and at a red heat instead of a white and scorching heat; also, since the supply of air to the fuel is lessened, by so much is the demand for a supply of air to the room lessened, which, as a rule, is drawn to the fire in the form of a *draught*. It will be found, with these fireplaces, the doors and windows may be kept open without the slightest discomfort or draught, owing to the fact that the fire draws in less air, and so slowly as not to be perceived as a draught. Although the supply of fresh air to the fuel is drawn in slowly, the life of the fire is so much prolonged that the demand for fresh air is constant, and the room is well and continuously ventilated, whereas with the old-fashioned fireplace the ventilation of the room varies as the fire is burning furiously and drawing in a draught of cold air, or is nearly out and drawing next to none. This surrounding of the fuel on all sides with fire-brick not only makes the fire hotter and more comfortable, but it also makes it last longer. As a rule, after first lighting it need only be mended twice in the day. A great saving, therefore, is gained, not only in fuel but in labour also. The advantages claimed for these fireplaces are:—1. Less labour, (*a*) no ironwork to clean; (*b*) less mending of the fire to be done, and therefore fewer coals to be carried; (*c*) the ash-pan can be removed, and the ashes emptied outside without causing dust. 2. Economy of fuel, with increased brightness of fire. 3. A front hob, forming a hot plate on which to keep things warm and boil water without blackening the kettle. 4. Less draught in the room. 5. A good toasting fire. 6. Adaptability to any form of opening or fireplace. 7. They may be had in the cheapest form suitable for cottages, or with elaborate ornamentation.

SCIENCE TO DATE.

Hydroxylamine.—This substance, NH_2OH, which has been known in aqueous solution for many years, has now, owing to the researches of some French chemists, been successfully isolated, and can be prepared by simple methods. About two years ago a compound of hydroxylamine with zinc chloride was discovered, which is easily prepared. If this substance is made into an emulsion with absolute ether, and then dry ammonia gas is passed through the mixture, an energetic action occurs, by which the whole of the hydroxylamine is liberated and is dissolved by the ether. By careful evaporation of the ethereal solution, after separation from the other products of the reaction, crystals of hydroxylamine are obtained. These crystals liquefy rapidly when exposed to air, owing to the absorption of water. When pure, however, they are very stable. They explode very violently when heated to 80° C.

Aconite.—As a result of his investigations of the aconite alkaloids, Professor Dunstan has obtained from the roots of *Aconitum napellus* three distinct alkaloids: one crystalline — aconitine — possessed of very poisonous properties, and two amorphous—aconine and napelline.

A Large Diamond.—A diamond weighing 205 carats and perfectly octahedral in shape has been found at Kimberley. It is the second largest stone ever found at the Vaal diggings, the first being that known as the Spalding diamond, which weighed 280 carats.

Application of the Microphone in Medicine.—It is stated that Hughes' microphone has been used successfully in St. Petersburg to ascertain whether the heart of a person supposed to be dead was still in action.

Cure for Snake Bites.—A hypodermic injection of strychnine has been tried with success for this purpose.

NOTES FOR WORKERS.

VACCINE virus has been cultivated by a Russian physician. It is said that this artificial lymph is as effective as the genuine, and has the advantage of being free from germs of scrofula, tuberculosis, etc.

NEARLY all the vessels navigating the Volga use naphtha for fuel. Naphtha being there cheaper than coal or wood, is coming into more general use among the manufacturers in Russia.

BLOOD consists of a colourless alkaline fluid—the "plasma"—in which float innumerable minute bodies called "corpuscles," most of those in human blood being yellowish-red, the rest being white or colourless.

THE temperature at which a liquid will boil in an open vessel is dependent on the pressure of the atmosphere.

THE formula for finding the circumference of a circle—such as a wheel—is $2\pi r$, where r is the radius of the circle and $\pi = 3{\cdot}1416$.

THE total output of pig iron in the United States during 1891 was 8,279,870 tons. That of Bessemer steel rails was 1,219,874 tons.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

HARDWARE TRADES.—The Sheffield stove-grate trade is dull in most departments. Makers here are busy with register stoves for the better class houses. The novelties known in the trade as the ventilating dog-grates are being extensively made. The latest types have a canopy of brass over the top, which, while improving the general appearance of the stove, prevents the smoking, which was an objectionable feature of the older types. They are usually fitted and mounted with brass in plain and fluted surfaces, these being more easily cleaned. Iron seems to be going out of use except for fire-resisting purposes, and brass and tiled patterns find most favour. In Sheffield the demand for railway material continues to be fairly good—in fact, much better than could have been expected from the troubles in the various industries. Manufacturers in the Sheffield district are anxiously looking forward for the termination of the Durham strike, as on this will depend the supply of hematite pig-iron. The whole of the available stock of reliable brands has been almost exhausted, and the furnaces have been damped down for the present.

IRON TRADE.—The Durham miners' dispute not having been settled, the Middlesbro' market was stronger. The complaint now is scarcity of supply, and practically the stocks of pig-iron are nearly all exhausted. There is only about 200 tons of No. 1 Cleveland, all in the hands of one firm, who decline to sell under 45s., which is equal to the best price paid during the recent "boom" on Swedish account. The only qualities in stock are No. 3 and white, but outside the warrant stores only small quantities can be had, and the stocks in the public warrant stores are being rapidly depleted. Shipments are comparatively heavy, consumers abroad pressing for deliveries. Makers will not accept less than 40s. for No. 3, but merchants offered to sell at 39s. 6d., and buyers offered 39s. 3d., but no business seems to have been done at that; Middlesbro' warrants were offered at 39s. 2d. cash. Iron founders are fairly well situated, and finished iron and steel producers are doing better. Steel plates are £5 17s. 6d.; iron ship plates, £5 10s., iron angles, £5 7s. 6d.; and steel angles, £5 15s.; common bars, £5 10s., all less 2½ per cent., and f.o.t. for forward delivery, but 5s. more is required for prompt delivery. Good South Yorkshire coke is delivered at 17s. 6d. per ton, and Durham foundry coke has realised 25s. per ton delivered.

OIL TRADE.—Turpentine is now much cheaper than usual, there having been a steady fall in value to 24s. 9d. per cwt. Linseed oil holds firm at 19s. 6d. to 20s. per cwt. Common resin, 4s. 1½d. per cwt.; medium ditto, 4s. 6d. to 6s.; fine ditto, 6s. 6d. to 9s. 6d. per cwt.

SHIPBUILDING TRADE.—The Liverpool shipbuilding trade is very quiet. Messrs. Potter & Sons have launched a sailing vessel of 2,400 tons, built of iron, and have on hand another vessel, a ship of 3,200 tons, both to order of Messrs. Maciver, Marshall & Co.

COAL TRADE.—There is a gradual slackening off in this business; for shipment steam coal is offered at from 9s. 3d. to 9s. 9d. per ton delivered at High Level or Garston Docks, Liverpool. In house coal there has been a moderate shipment to Ireland.

CABINET TRADE.—Liverpool cabinet makers are fairly busy. The rate of wages for cabinet makers is 8½d., and for upholsterers 9d. per hour, but the pay is mostly for piece work.

WATCH TRADE.—In Birmingham the watch trade continues very dull. The English Watch Company's working hours have been reduced to thirty-six hours per week, Saturday and Monday being play days, which is expected to continue throughout June and July.

ENGINEERING TRADE.—There is no change in the Lancashire engineering and iron industries, the only new work of any weight coming forward being mostly of a special character. Boiler-makers, however, continue to issue satisfactory reports. The Whitsuntide holidays have been seized upon as an excuse for stopping several concerns for several days, and the iron trade is in consequence becoming still more unsettled. There can be no doubt that the present continued depression is in a large measure due to the very general feeling which prevails among manufacturers as to the urgent necessity of reducing wages. The opinion is freely expressed in this district that the Durham strike is only a prelude to a general movement of a similar character in the other centres. The question of reducing wages is certainly under consideration so far as the engineering industries of this district are concerned, and there is little doubt that any such attempt would lead to serious disturbance in the labour market. With such prospects, the condition of the iron trade threatens to become still more serious. The steel trade has of late maintained a firm tone both as regards raw and manufactured material, but only a small amount of business is being done. For steel boiler plates makers have lately remained firm at £8 per ton.

JUTE TRADE.—Trade in jute goods is flat in Dundee. Several spinners intend closing their works as soon as the jute they have on hand is used up. The market continues in a depressed state.

CYCLE TRADE.—In all the manufacturing centres of England and Scotland makers are fully employed, many of them working overtime. The "Swift," Coventry; "Star," Wolverhampton; "Sunbeam," Wolverhampton; "New Home," Glasgow; and "Elswick," Newcastle, with many other good makers, are in great demand, and dealers complain of the delay in receiving supplies from the makers. The North British Machine Company, doing a large wholesale business in Glasgow and Manchester, have done exceptionally good business this season, having disposed of nearly 1,000 Safeties in excess of the number sent out up to the same period last year.

TAILORING TRADE.—The Fraserburgh branch of the Amalgamated Society of Tailors has adopted the Scotch time-log.

TIMBER TRADE.—The dock deliveries show an increase. The figures are:—

	1892.	1891.
Floated Timber ...	1,206 loads	377 loads
Deals and Battens	4,093 stds.	3,212 stds.
Prepared Boards..	1,201 ,,	932 ,,

being an increase over last year for the corresponding week of 1,150 standards and 829 loads. A fine parcel of pitch pine timber in sizes from 9 in.×9 in. to 19 in.×19 in., and in lengths from 14 ft. to 46 ft. long, were sold at Liverpool by Messrs. Farnworth & Jardine, at from 11⅜d. to 17½d. per foot. Some 4 in.×9 in., 3 in.×9 in., and 2½ in.×7 in. yellow, this year's import, were sold at Winchester House at from £2 15s. to £3 5s. per standard, *i.e.*, 4 in.×9 in., at 1⅛d. per foot run, and 3 in.×9in. at 1d. Reckoning 23s. for freightage, and 10s. landing rate, it does not leave much for the timber.

BUILDING TRADE.—At Nelson a dispute is pending between the master builders and contractors on one part, and the stonemasons and stonewallers on the other. In Durham county trade is fairly brisk, the great difficulty being that of obtaining bricks. At a meeting of Edinburgh joiners an increase in wages from 7½d. to 8d. per hour was demanded. Progress was reported in the preparation of a uniform mode of measurement for carpenters' and joiners' work, similar to those in use in Glasgow, Dundee, and Aberdeen. In Rochdale and district the stonemasons are still out on strike for the ½d. an hour in dispute. All the other building trades are going on comfortably, there being plenty of work. A notice for an advance of ½d. an hour sent in by the joiners expires on July 1.

LINEN TRADE.—In Dundee there is a moderate extent of business in the finer descriptions of goods. Flax and tow yarns are dull.

CARRIAGE TRADE.—This is now at the zenith of briskness, though far from what it should be at this time of year. The shabby vehicles of all sorts far outnumber the bright ones, although a coat of varnish for a two-wheeler is only £1 10s., and for a four-wheeler or private carriage from £2 10s. upwards.

JEWELLERY TRADE.—There are a few orders about, but these are not of importance. It is unlikely that there will be more than a week or two's busy time, and should the election come on, there will not be the faintest chance for London trade for a month or two.

COTTON TRADE.—Two new mills have started with about 200,000 spindles. A strike at Accrington, which has lasted for seventeen weeks, has been settled. It was caused through the employers refusing to allow the spinners compensation for extra work.

SILVER TRADES.—Improvement continues in the Sheffield silver trades. Orders are coming from the Australasian colonies, and business is looking more hopeful all round.

DECORATIVE TRADE.—Liverpool painters and paperhangers are busy as usual at this time of the year, but not more than in former years. The fine weather of the last few days has created a demand for a few steady men.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

I.—LETTER FROM A CORRESPONDENT.

Hobbyists' Emporiums.—E. D. (*London, N.*) writes:—"This suggestion of yours, in No. 160, was such a valuable one to my mind, that I quite anticipated considerable correspondence from able pens would have resulted ere this. I am pleased to find J. W. R. (*East Liss*) starts the ball rolling in a recent number (No. 164). That an emporium would be a boon needs no confirmation; but how can it be brought about? I will venture a few suggestions with your indulgence:—An association of home workers with a title such as, 'Ye Home Arts and Crafts Guilde and Marte,' with a depôt as central as possible in London, for the display and sale of the works of members; and a stall occasionally at certain of the suitable exhibitions which are held in London—the Building and Decorative trades, for example. A small annual subscription, payable in advance, to entitle to membership; the first subscription to be accompanied by a printed form (to be obtainable on application to the secretary of the Guilde, with a stamped addressed envelope) making declaration:—'That the applicant will only offer such articles for disposal as are his or her own production, and that he or she will not submit in his or her own name articles made by relatives or friends.' All articles to be sent carriage paid to the depôt and at the owner's risk in transit. A small commission would, of course, be required on goods. It would be necessary someone be appointed at the depôt to receive goods, attend to customers, etc., and this person would have to be paid, and I would suggest part by salary, and a commission on the sales effected. Doubtless, little difficulty would be experienced in finding a trustworthy and suitable person, either male or female. The affairs of the Guilde to be vested in a committee of, say, eight members (elected annually at general meeting) and a secretary. The committee should form themselves into four sub-committees of two members each, and those should take a once a week supervision of the depôt, for a month at a time, three times a year. The question of remuneration (small) to secretary, and whether this service by committee could be expected to be entirely voluntary, I will not raise now. In fact, I think for the present enough is said, but must add a big suggestion, as far as you, Sir, are concerned, and trust you will not consider me too expectant:—Will you, for three weeks subsequent to the appearance of this letter, kindly allow any who view such a scheme as this emporium one favourably to send their name and address—at the same time their suggestions will be welcome—and offers of preliminary help from those in London, to 'Memrud,' care of the Editor of WORK, Messrs. Cassell & Co., Ltd., London, E.C., with 'Hobbyists' Emporium' written on top of envelope? And if you will give us help yet further by reminding readers in the three subsequent numbers of WORK to send in their names, I am sure you will merit and gain the gratitude of very many of us. At your convenience, at the end of the time, I would call or send for the letters, and endeavour therefrom, with some volunteer help, which will, doubtless, be forthcoming, to arrange a preliminary meeting." [Any letters reaching us will be received. E. D. had better call, as while we can accept no responsibility in this matter, the suggestion is entirely our own, and we should like to see the thing properly carried out through WORK, for the benefit of its thousands of readers.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Bicycle Varnishing.—A. W. (*Manchester*).—The information has been minutely given in WORK, both in the bicycle papers and to correspondents in reply to their queries. Consult Indexes for painting bicycle.—A. S. P.

D Dulcimer.—J. B. (*Fourstones*).—The inside treble bridge must be placed 2½ in. to the left of the centre in front and 1 in. at back, and the bass bridge 3 in. from, and *parallel* to, the wrest-pin block; the outside bass bridges at the same distance; the outside treble bridges do not stand in a straight line from front to back, but are placed somewhat irregularly, to obtain the chromatic scale. Their proper places can only be determined when the instrument is finally tuned. To find the positions for the sound-holes, mark the positions of the *inner* bridges on the sound-board; then draw a line down the centre of each division, and on these lines, at a distance of 4½ in. from the front and 3 in. from the back, will be found the exact spot required.—R. F.

Lenses.—SCIENTIFIC.—The best known optical glass makers are Chance, of Birmingham, Feil & Co. and Rosette, of Paris, Shott & Co., of Jena, Germany; but these big firms would not pay much attention to the small wants of the amateur. It is far better for you to go to some dealer. The best supplied of them, probably, is Mr. Caplatzi (see "Sale and Exchange" column). He has glass of all the above-named makers, polishing powders, and tools as well, and sells in any quantity, according to his catalogue. Those amateurs who like to make their own grinding tools will find it easiest to procure samples of the lenses they wish to grind, and use them as patterns to cast from in brass.—C. A.

Tempering Steel.—FAITHFUL READER.—Do you mean "crucible cast-steel" or steel castings? If the former, yes; if the latter, no.—J.

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Forge.—TINKER.—I send sketch of forge in Fig. 1 without fan or driving wheels, so that you may see the construction more clearly. The pan or body of the forge is of strong sheet iron, turned up and riveted together. A piece is generally cut out at each side, for laying articles level on the fire. The legs may be of gas-pipe, about 1 in. in diameter, bent out at the bottom, flattened at the top, and riveted to the pan. Two stays are shown riveted to the legs, the others being fixed to suit the position of the wheels and fan; or bars of iron, about 1¼ in. by ⅜ in., may be used for the legs. A hood is shown, which is made of sheet iron and riveted to the pan. A tuyere will be fixed in the side of pan, into which the air-pipe from the pan will be fixed. A fire-brick lump may be laid on the pan for the fire, which will protect the iron. The driving wheels and fan are shown in Fig. 2, and will be fixed at the

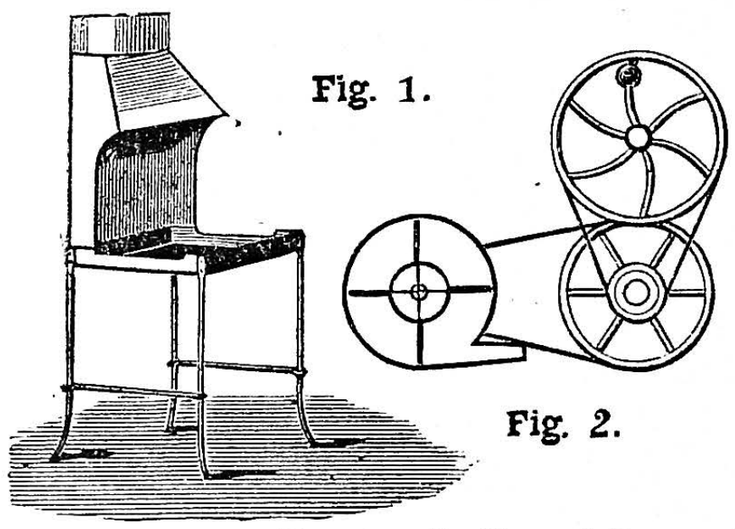


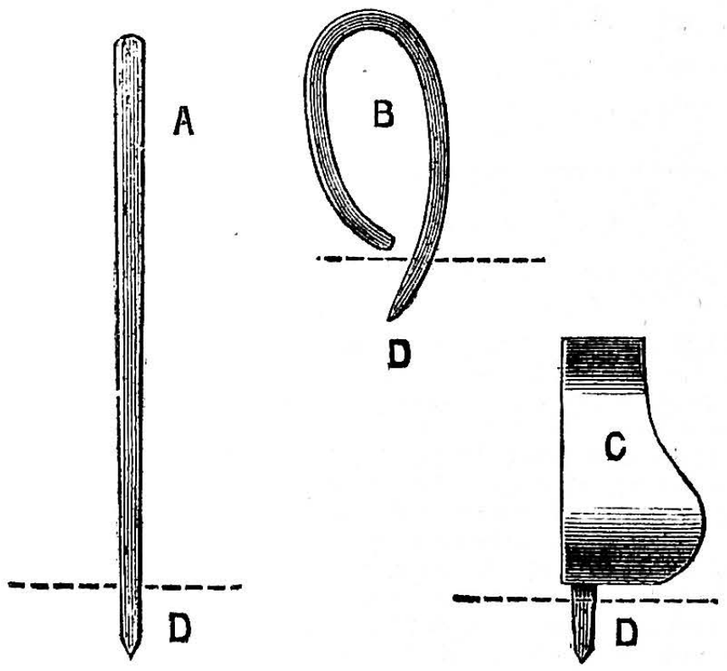
Fig. 1.

Fig. 2.

Fig. 1.—Forge. Fig. 2.—Section of Fan and Driving Wheels.

end where the hood is. The driving wheel may be 10 in. or 12 in. in diameter, with a belt to a 3 in. pulley on intermediate shaft, and another wheel 9 in. or 10 in. on this shaft, with a belt to the pulley on fan shaft. The fan should be about 9 in. in diameter and 4 in. wide, with case of sheet iron, and a ¾ in. iron pipe carried from it up to the pan. The arms of the pan are of iron securely fixed to the shaft, and the vanes of sheet iron riveted on. A handle is fixed on the driving wheel. Sometimes the driving wheel is a spur wheel with teeth gearing into a small pinion on the intermediate shaft; this will enable the wheels to be fixed closer together. Cross-stays are fixed to suit the centres of the wheels in which they are fixed.—M.

Zither.—J. D. (*Aberdeen*).—If you have Fittigs' instruction book, you have as good a one as there is in the market at the present time. Until you have gained a complete mastery over ordinary major chords, do not think about any others, or about the many various modes of accompaniment. Such things do not come within the scope of an elementary course (*vide* WORK, No. 151, "Shop," page 747, "Hints on Stringing the Zither," being a reply to a critic who advanced such methods of accompaniment as unteachable by my simple system). The Elégie zither is not the one you should have purchased, but it is possible for you to learn on it all right with a little more patience. As to the glissando, etc., you have no business to attempt



Zither Ring or Plectrum—Tongue of Horn, Tortoiseshell, or Metal before bending to fit, actual size; B, Ring bent to Shape; C, So-called "Concert Ring"; D, The "Tongue," the only important part.

any "graces" until you have entire control over your instrument. Let all such things rest for the present. With the "Triller" it is somewhat different, as this grace is required to *sustain* any note. It is easily managed, but requires a little patience at first. Practise it with either of the three fingers, keeping them *perfectly upright*, and let all the motion be from the last joint of the finger, and at right angles to the fret. Make it slowly at first: a rapid trill will come by practice. Only *one* "scale" need be practised on the zither; it is no use wasting time over them. Your ring evidently does not fit your thumb. Make one for yourself according to the diagram. If you buy one, you must fit yourself, but you will have to pay much more than the value, as there is nothing in them beyond the tongue, which may be affixed to the thumb in any way you prefer. Make one of horn, tortoiseshell, or metal—whichever you prefer. I prefer the former, as they give a better tone, being flexible. If you decide upon horn, file up the prong, and then boil it to soften, and bend it to fit while flexible. If metal, then thick copper wire, filed to shape, does very well. The proper shape is shown in the diagram. A ring of some sort is indispensable, which you can procure at any good music seller's. If there is not such a house in your town—or if they have not got one—write to Messrs. Henshaw & Loebell, Swan Street, Manchester, together with the size, by means of a hole cut in a piece of card. Also say whether you prefer the plain or the so-called "concert" shape, which is also shown in diagram. Fittigs' book contains plenty in the way of very simple airs—in fact, I cannot direct you to any simpler. If you devote an hour a day to practice, you may play very well in a month. Of course, you will not become a *virtuoso* in that time, but you will have acquired a practical control of your instrument, and will have all the necessary knowledge to carry you to any lengths—all the rest is application and practice. I ought to have said that, to fit properly, the ring should require to be *sprung on* over the thumb-nail.—OLD TEACHER OF THE ZITHER.

Camera Blind.—The width of the slot is usually about an inch, but is quite arbitrary, the more narrow the opening the more rapid the exposure, and *vice versâ*. One end of the blind should be supplemented by mere bands on each side attached to the roller, which have to be wound up before setting the shutter, in order to limit the uncoiling to the opaque portion containing the exposure slot. There are other methods of obtaining the same ends, but this is as convenient as any.—D.

Bookcase.—J. C. R. (*Culross, N.B.*).—Twisted pillars will not be out of character with the style you mention, although they are more properly associated with antique and Jacobean furniture. But even if they were, why regard the incident as of importance? The main object is always to provide suitable and tasteful articles, and whether the design is of a mongrel class, it matters little, in my opinion, provided the satisfaction given is what is desired. This is not the place to discuss styles, but I should have liked to launch forth on what I regard as the slavish humiliation indulged in by strictly building furniture on the accepted lines of the respective styles. I often see Early English cabinets in apartments with French, Italian, or antique chairs. This is a more idiotic course to adopt than would ensue by mixing the styles and fitting spindles to various parts of the chairs, and lions' heads, fruit, and other carving to the cabinet. You evidently like twisted pillars; then I should advise you to use them, whether some bigoted designer regards them as incongruous or not.—J. S.

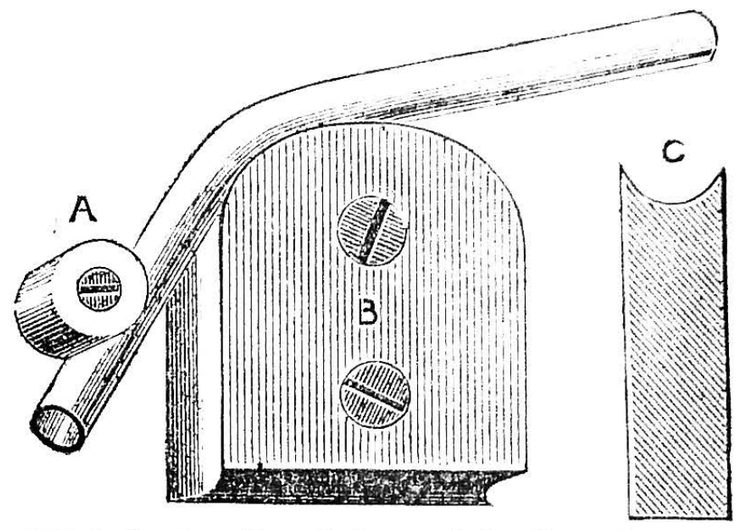
Dressing-Table, Working Drawings, etc.—A READER OF "WORK" (*Clonmel*).—You want working drawings of "back for a fancy dressing-table with a mirror about 18 in. by 14 in., length of dressing-table about 3 ft. 2 in.; a house ladder; and two meat safes—one for inside, the other for outside use." Perhaps some competent reader will put himself in communication with you. Of the cost I can say nothing, as each man usually charges according to the dictates of his conscience. I should have been pleased to assist you myself, but other work prevents such a result.—J. S.

Electric Battery.—SMITH.—This correspondent writes: "I bought an electric battery for my wife (who has been ailing with rheumatics) for £3 10s., about two years since. The vendor said it would last a lifetime with care. In six months after I was going to put in a fresh solution of sal-ammoniac, but it would not hold the solution. The cells are made of tin, and they were eaten full of holes with the salt." I quote this from your letter to warn others against dealing with such "professors." The sketch of your cells, which you have been good enough to send me, shows that he supplied you with two Bennett cells, each 4½ in. by 2½ in. by 2½ in., worth at the most only 2s. each. The cells are now useless. If you will write and tell me what you have besides these, and what you wish to do, I shall have much pleasure in advising you.—G. E. B.

Intensity Coil.—G. H. (*Rickmansworth*).—If the core is intended for a spark coil, it is much too short. A core ⅝ in. in thickness should have a length of 6 in. If you wish to use the core and carcase for a spark coil, wind two layers of No. 20 silk-covered copper wire over the core for the primary, and 8 oz. of No. 38 silk-covered copper wire for the secondary, coil. With a condenser of fifty sheets of tinfoil 2½ in. by 2 in., and current from two pint bichromate cells, you may get a ¼ in. spark. If you wish to use the carcase for a medical coil of one power, wind four layers of No. 24 silk-covered wire on the coil for the primary, and 8 oz. of No. 30 silk-covered copper wire over this to form the secondary coil. The wire can be obtained from Mr. Bottone, Wallington, or from Mr. Caplatzi, 3, Chenies Street, Tottenham Court Road, London, if you cannot get it in your locality. You can also get the paraffin wax from the same vendors. You certainly could not make it at home, as it is *not* made by adding paraffin oil to beeswax.—G. E. B.

Battery for Telephones.—F. S. (*Deptford*).—If the telephones are of the Bell permanent magnet pattern, as described in WORK, No. 28, p. 439, Vol. I., no battery will be required; but such telephones can only be worked on short lines and in quiet localities. Long-distance telephones require a battery to work them. The battery in general use and favour for this purpose is the ordinary Leclanché as used with electric bells. Dry batteries—such as the Gassner, E.S., and E.C.C. cells—may also be employed to work long-distance and loud-speaking telephones.—G. E. B.

Pipe-Bending Machine.—J. P. (*Handsworth*).—The machine you refer to, described in "Shop" columns some time ago, was for turning tubes, not for bending them. You can bend them by filling with resin or lead. I have always managed to bend in a hole in the bench, rounding off the part where



Block for bending Tube, and Section of same.

the tube presses against so as to avoid bruising or marking. If it is a tube that has to be finished, bend before finishing. A wood block, as shown in sketch, screwed to the bench would perhaps suit you. A is a stop fixed to the bench by a screw, B, the bending block, C, section of same.—R. A.

Panelled Dado for Hall.—E. R. A. (*Devonport*).—I should not have room to give anything that would really help you in "Shop," but I will (with our Editor's permission) prepare an article which shall show a design for such panelling as you want, so constructed that any amateur carpenter can carry it out, and it shall be accompanied by all necessary working diagrams.—M. M.

"Sole Trimmer."—J. P. (*Reigate*).—You ask "if it will be worth your while to patent" the tool you refer to in your letter. Well, that I will not venture upon, but anything that is novel, or, in other words, original, is, I always think, worth a trial. From you saying it is like a spoke-shave, I think perhaps it may be a tool of some use in many kinds of work, such as heavy or wide welted (machine-sewn), or in riveted work, but then it would need a guard—not only, as you say, "to prevent it cutting the upper leather," but also to lay on the top of the sole while it is being run round, and this so that you may get not only power, but an even stroke also. You say "trimmed ready for the heel-ball without the knife, rasp, scraper, or glass-paper." By this you err, as it would, at least, need the sand or glass-paper to close the fibres of the leather after any instrument had passed over it in one direction only, as the finished edge would look rough. But, as you say, it would be very useful to amateurs. And

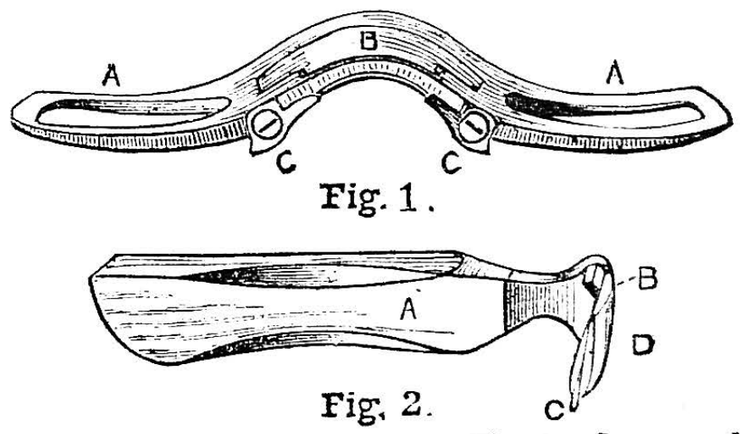


Fig. 1.—A Yankee Heel-shave. Fig. 2.—Improved Sole Plane.

now, having pointed out the way that you must look at it in, I will tell you what are already in the market, and their price, feeling sure that this to an intending patentee is one of the principal things to know, even if they are not a bit like his own idea, for he has then a better chance of judging that his is, or is not, a thing wanted and produced. Fig. 1 is a Yankee heel-shave, iron frame, price 2s. each; A, A, are the handles, B, the knife or cutting-iron, and C, C, the two screws that liberate it to be sharpened, or set for a coarse or fine cut. Fig. 2 is an improved sole plane, price 1s. 1d. each; A is the handle, B and C the cutting blade (B being the cutting end), and D the guard, which runs on the welt near the upper. You see, by this tool it is impossible to cut the upper; and, to end, I think I had better hint that all edges should be a little hollow, therefore your cutting-iron would need to be a little on the round.—W. G.

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Billiard Tables.—W. W. N. (*Leeds*).—No such papers have appeared. We only await the advent of a thoroughly competent writer to take up the subject.—ED.

Vol. I. of WORK.—W. H. (*Huyton*).—The published price of Vol I. of WORK is 7s. 6d., but it is out of print. You should advertise for it in WORK.

Sewing-Machine.—W. B. (*Walthamstow*).—An article on How to Adapt a Sewing-Machine for Fret-Saw Machine appeared in WORK, No. 56.

Brass-Polish—Glass Mending.—J. H. (*Leeds*). You should advertise your books in our cheap "Sale and Exchange" column.

Chimney-Top.—J. R. (*Bagnalstown*).—The only way in which you can see if the design is patented is by searching the records at the Patent Office, London.

Zither Music.—F. P. (*Northwich*).—There is very little music published otherwise than in the treble clef. The reason for this is that there would be many astonishingly high and low notes in the accompaniment and bass were the latter written in the bass clef; so the very objection you make is a very substantial boon to the great majority of zither players. It is surely much easier to read one clef than two. As to zither music with words, there is plenty published—most of it in Germany. I cannot say where you could procure any with English words, but think it is likely that such is to be obtained. Write to Herr J. Goebel, Museum Street, London, or at Mitchell's Library, Old Bond Street, who will probably be able to furnish you with what you require, or, at any rate, to give you more information on this particular subject than I can, as I have had very little to do with zither music for some years. If you have A. Davis' series, you have as fairly representative a selection as any of which I know: but the gentleman mentioned above will most likely be in a position to put you on the right track, as he is a well-known performer, as well as a teacher, of the instrument. Having in view the very severe strictures which one correspondent has thought fit to pass upon my advocacy of the metal strings, it is satisfactory to learn that you fully appreciate their superiority. In my own opinion, their pre-eminence over the ordinary silk and gut ones is self-evident; but so much depends upon what sort of touch the player has acquired. I shall always be happy to answer queries respecting the zither, and regret that in the present instance I am unable to give a categorical reply.—A. O. T.

Zither Music.—C. S. (*Liverpool*).—The great bulk of music for the zither is published in Germany. I am unable to tell you where to procure any of English origin or with English words. Try Litolffs', who publish a fair variety of zither music, or Metzler. Failing these sources, your only course would be to get whatever songs, airs, etc., which you might select transposed to suit the instrument. This would mean the simplification of the melody or the re-arrangement of the chords, and the proper arrangement of the accompaniment in the treble clef, so as to avoid very high or low notes on ledger lines—which is the reason why the treble clef is retained for the accompaniment and bass in most zither music. I have seen music for the zither written as for the pianoforte, but there is comparatively little of it in the market. Nevertheless, inquiry among the publishers cannot fail to elicit all information as to such music. I am sorry I cannot give you a more satisfactory reply; but you must remember that the great majority of players are quite satisfied with the music of German publishers. Write to Treffenbrünner, of Munich, or Riendl, of Vienna, for lists of high-class zither music. It is possible that some English songs are published in Germany.—A. O. T.

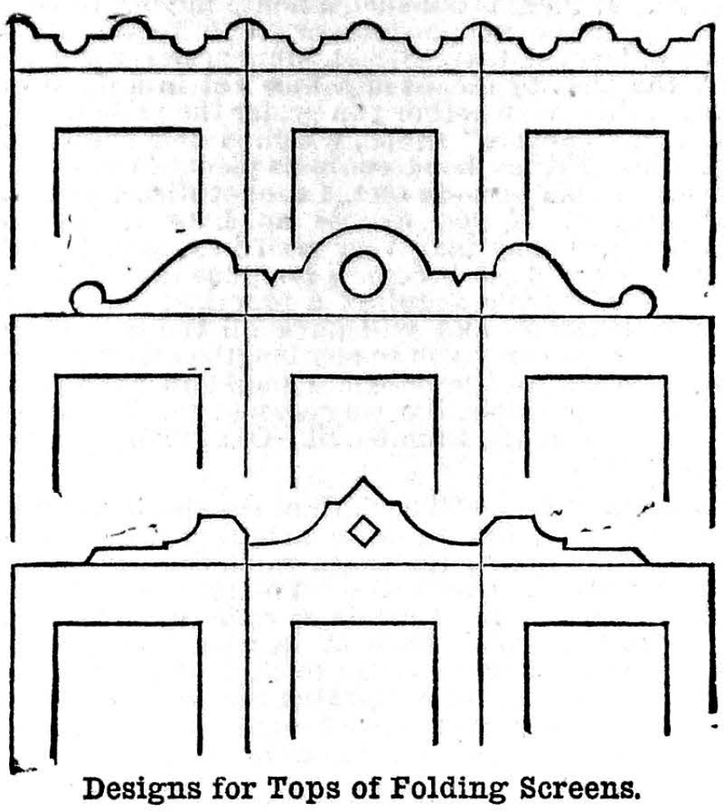
Phonograph and Platinum.—A MONTHLY SUBSCRIBER.—An article on "How to Make a Phonograph" appears to-day. About scrap platinum, write to Messrs. Johnson & Matthay, assayists, Hatton Garden, London.—W. D.

Wire Dulcimer.—J. L. S. (*Paisley*).—If by a "wire" dulcimer you mean an ordinary dulcimer of wood strung with wire, you will find full instructions for making such an instrument in Nos. 31, 38, and 41, Vol. I., of WORK.—R. F.

Electrical Lessons.—H. C. (*Euston Road, W.C.*).—The construction of electric bells has been fully described and illustrated in the articles on Burglar Alarms published in WORK, Vol. I., pp. 179, 279, 311, 418, 484, 537, 682, 699. You cannot do better than to get this volume, and continue reading electric papers in WORK, Vol. IV.—G. E. B.

Course of Study for Engine Driver.—R. W. (*Birmingham*).—Study the principles of the sciences which govern the working of steam engines. You will find these in the lessons on Mechanics, Hydrostatics, and Heat in the "Popular Educator," and on the Steam Engine in the "Popular Educator" and in the "Technical Educator." As you are about to learn how to take charge of the engines and dynamos at a new public baths, you will find some lessons on Voltaic Electricity and on Machines for Raising Water in the "Technical Educator." To extend your knowledge of electrical science, I should advise you to study "Electricity in the Service of Man"—a good book. This and the Educators may be had in monthly parts, if you prefer to have them in this form, and then bind the parts together. Some of the best books on the steam engine and on electrical engineering are very expensive, but perhaps you may be able to get access to them in one of the public libraries or mechanics' institutes in Birmingham. A study of such books as I have mentioned, and a practical application of the principles gleaned from them, under the advice and direction of the engineer in charge—who will, I understand, teach you—should enable you to become a proficient workman. If you get into any difficulty in not being able to understand what you read or what you see, make use of us in the future as you have in the past.—G. E. B.

Top of Folding Screen.—T. D. (*Gateshead-on-Tyne*).—Something very simple will best suit the top of your screen. Here are three sketches, one of which will probably serve your purpose or suggest what you want. My plan would be to saw out the one selected from ¾ in. braid, and, as firm fixings



Designs for Tops of Folding Screens.

will be essential, I should, in addition to glue, run a long dowel or two into the broader part of each division, and through the narrower drive a screw down into the top edge of the screen. Your ornamental top will then be in no danger of being knocked off.—M. M.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Marbling.—EFFBEE writes:—"I should feel obliged if any reader would tell me how to make water colours float on water for marbling purposes."

Wood Stain.—H. W. T. (*Harrow*) would like to know the best stains for wood to show the grain.

Cut Boot and Shoe Leather.—W. L. (*Leith*) writes:—"Would any reader kindly give the address of a wholesale firm who sells leather cut into soles and heels?"

Distilling.—G. H. L. (*Peckham*) writes:—"Having constructed a 'Liebig Condenser' from instructions by R. W. C. in No 157, I now want a worm condenser. Will R. W. C. kindly inform me if it should be of tin plate, or will the *drawn* tin pipe answer? Also, will a 3-quart saucepan—the size wanted—with a head fitted to it fulfil the purpose of distilling from a saccharine preserve similar to a fruit jam?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Model Locomotive.—M. (*Bishop Auckland*) writes to E. W. L. (*Newcastle-on-Tyne*) (see No. 163, page 110):—'Model Engine Making,' by J. Pocock, contains articles on 'Model Locomotive Making.'"

Knee-hole Desk.—M. (*Bishop Auckland*) writes to H. L. (*Oxford*) (see No. 163, page 110):—"If you write me with particulars, I will be glad to help you with instructions or drawings."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. T. (*London, E.C.*); PATENTEE; A. B. (*Sheffield*); R. P. (*Horsham*); B. H. (*Winsford*); F. H. W. (*Southampton*); CONSTANT READER; C. B. B. (*Westbury-on-Trym*); S. M. (*Derby*); J. P. H. (*Oldham*); A. P. (*Nottingham*); J. B. (*Leeds*); LAWTON; J. W. B. (*Huddersfield*); L. G. (*Bradford*); H. H. (*London, S.E.*); G. S. W. (*Dewsbury*); A READER; W. R. (*Stepney Green*).

"WORK" PRIZE COMPETITIONS.

THE Editor of WORK has the pleasure of calling the attention of his readers to the following scheme for Prize Competitions, which he will feel obliged by their bringing under the notice of friends and others interested in any of those departments of work, or employment, which the prize scheme is intended to stimulate.

Fully sensible of the interest which many thousands of the readers of WORK take in matters of a competitive nature, this prize scheme has been deemed a suitable sequel to the WORK Exhibition, in which so many readers obtained honours.

A general subject has been considered best with which to commence; and as most of the readers of WORK and thousands of the outside public know something of bicycles and tricycles, competition is invited for the best essay upon

"The Cycle: Its Worth to the Nation."

For the three best essays the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

CONDITIONS AND RULES OF THE CYCLE ESSAY COMPETITION.

ALL Essays to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the prize scheme is announced.

Each Essay to be signed with an original *nom de plume*, and to have the writer's real name and address securely attached to the manuscript in a sealed envelope.

No Essay to exceed more than two pages of WORK in extent, including any diagrams that may be necessary to elucidate the text.

In the work of judging regard will be had to original suggestions of value affecting the improvement of bicycles and tricycles, especially where such improvements are shown by diagrams.

All Prize Essays and Drawings to be published, if desired by the Editor, in WORK, but the copyright thereof to remain with the authors.

Copies of MSS. and Drawings to be retained by the competitors, as in no case can the return of MSS. be undertaken.

The Editor of WORK will supervise the judging of the Essays, and the selection as determined upon is to be final.

All manuscripts intended for the Cycle Essay Competition must be addressed to the Editor of WORK, c/o Cassell & Co., Ld., Ludgate Hill, London, E.C. They must reach him not later than Saturday, June 25, and should be legibly endorsed on the envelope or wrapper, "WORK Cycle Essay Competition."

Next Week's WORK (*No.* 170) *will contain full directions and diagrams for making* A CHEAP AND PORTABLE TENT FOR SEASIDE OR RIVER BATHING PURPOSES.

SALE AND EXCHANGE.

Victor Supply Co., Grimsby, sell Mail-cart Wheels and Parts. [4 R

Caplatzi's Matchless Technical Collections embrace most things electrical, optical, mechanical, chemical, photographic, models, materials. Catalogues, 2d.—Chenies Street, Bedford Square. [9 R

Lettering and Sign-Writing made Easy.—Also full-size diagrams for marking out eight alphabets, only 1s.—F. COULTHARD, Darlington Street, Bath. 100 Decorators' Stencils (60 large sheets), 2s. 6d.

100 Fretwork Designs (new), 100 Carving, 100 Repoussé, 30 Fret Brackets, 100 Sign Writer's Stencils (all full size), 300 Turning, 400 Small Stencils. Each packet, 1s.; postage free.—F. COULTHARD, Darlington Street, Bath. [1 S

Fretwork Designs.—40, 7d.; 12 brackets, 1s. 1d. Catalogue 300 miniatures, 6d. Lists free.—TAYLOR'S Fretworkeries, Blackpool. [18 R

Hasluck's "Lathe-work," 3s. 6d., new; Copper Boiler, 17 by 7½, 7 flues, new, 35s., worth double.—COOPER, Polegate, Sussex. [20 R

"Screws and Screw Making."—The best book on the subject, 3s.; soiled copies, 2s. The Buyer's Guide to the best Books on Mechanical Subjects, with table of contents, price 6d.; in cloth, 1s. 6d.—Published by BRITANNIA Co., Engineers, Colchester. [21 R

Wanted.—WORK, Nos. 1 to 52, with index; good condition.—MITCHELL, Valentine Street, Norwich. [3 S

Unpublished Trade Recipes.—Honestly worth pounds each. Prices moderate. Catalogue, 1d.—STANLEY, Billsow Street, Poplar, London. [4 S

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